SCIENTIFIC AMERICAN

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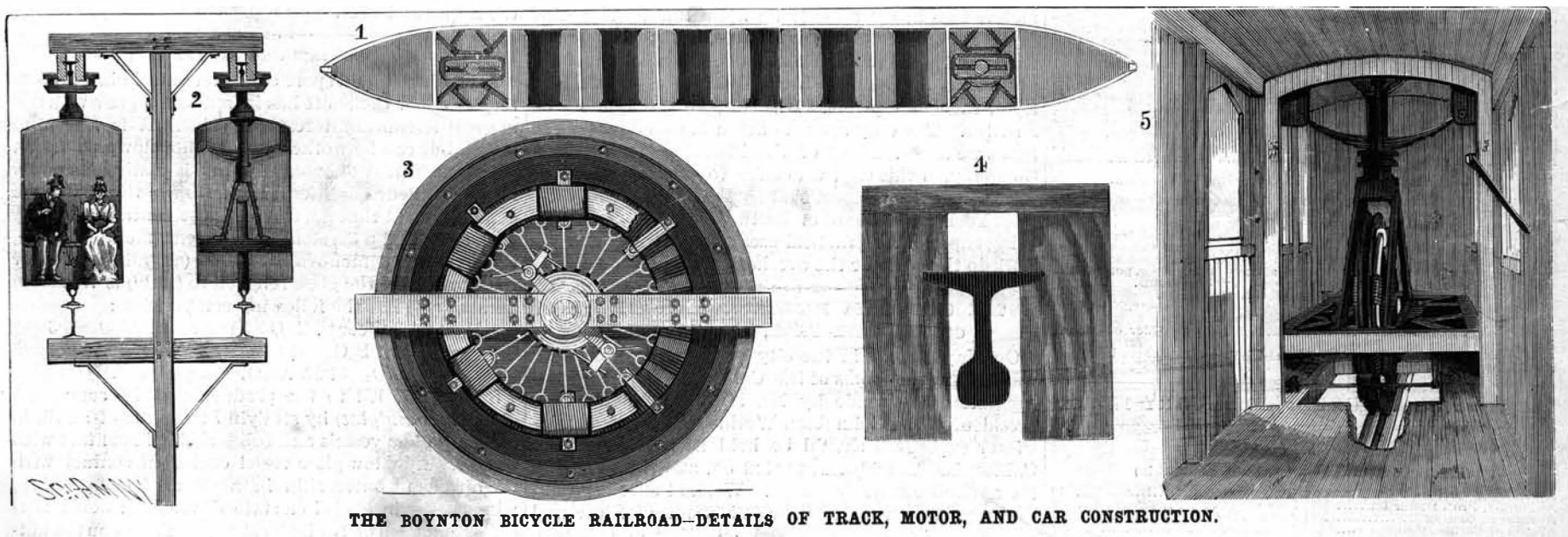
THE BOYNTON BICYCLE ELECTRIC RAILWAY.

The need of the day is rapid transit. Steam, cable, and trolley cars each in their own degree contribute to this end. The illustrations show one of the last developments in true rapid transit—the Boynton Electric Bicycle Railroad—of which a line is now in process of erection across Long Island, from Bellport to the Sound.

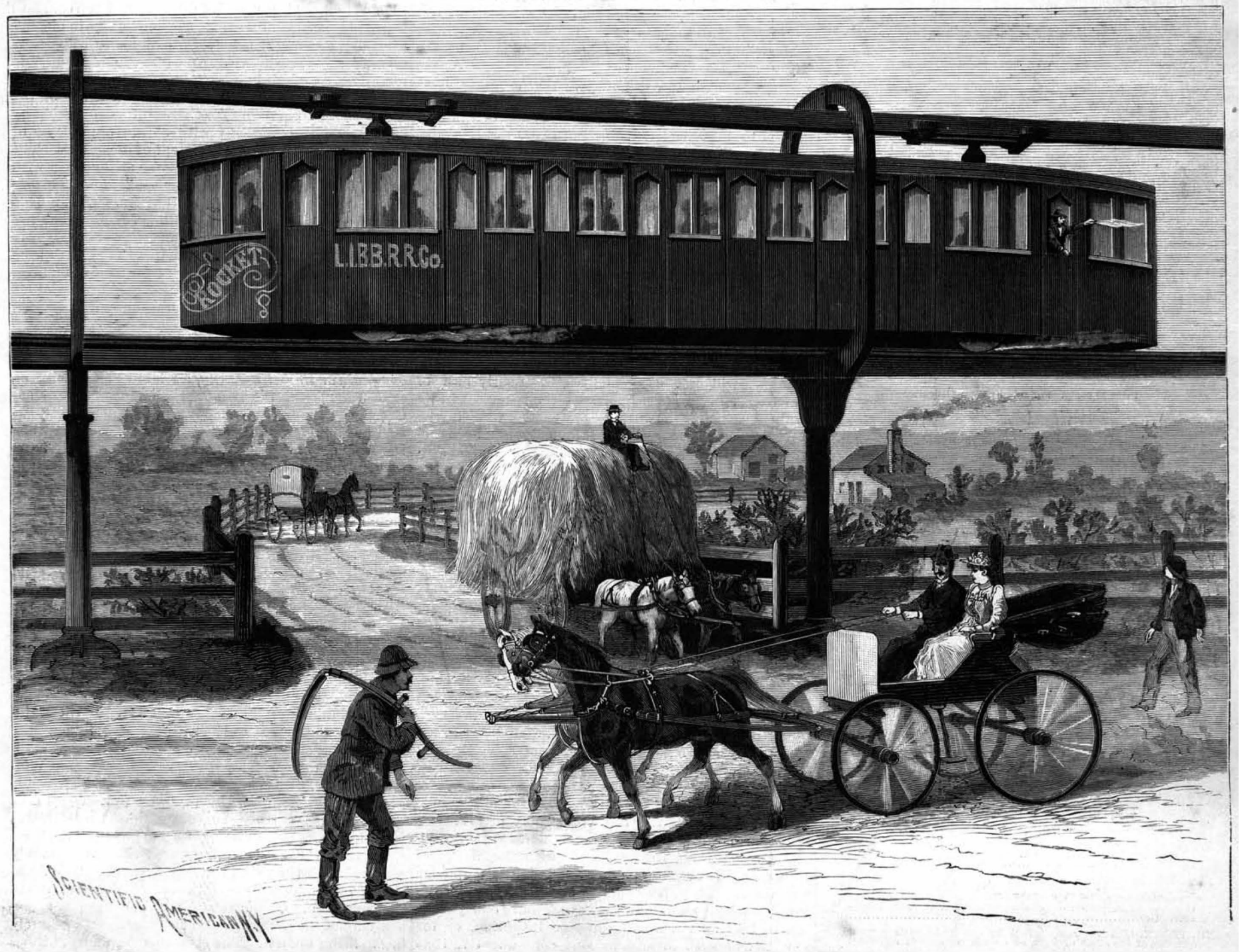
The idea of the bicycle railroad is to provide a system of transit whose speed may be from seventy-five to one hundred or more miles an hour. Air resistance being one of the most adverse factors at this velocity, a car of small cross sectional area is preferable. The inequalities of two parallel lines of rail is also a factor of resistance. In the railroad in question a narrow car with sharpened ends is employed, and is mounted upon two wheels, one at each end, and travels upon a single rail. It has the equilibrium of the bicycle, and like the latter disposes at once of the violent transverse wrenching strains which affect four-wheeled vehicles of the everyday type. It is peculiarly well adapted for electric propulsion, the overhead rail giving a place for the current main.

Referring to our illustration, Fig. 1 represents the plan of the motor car, showing its sharp front and rear ends, and its six compartments, each holding four passengers, who sit back to back. It is proposed in prac-

(*Continued on page 100.*)



THE BOYNTON BICYCLE RAILROAD—DETAILS OF TRACK, MOTOR, AND CAR CONSTRUCTION.



THE BOYNTON BICYCLE ELEVATED RAILROAD.

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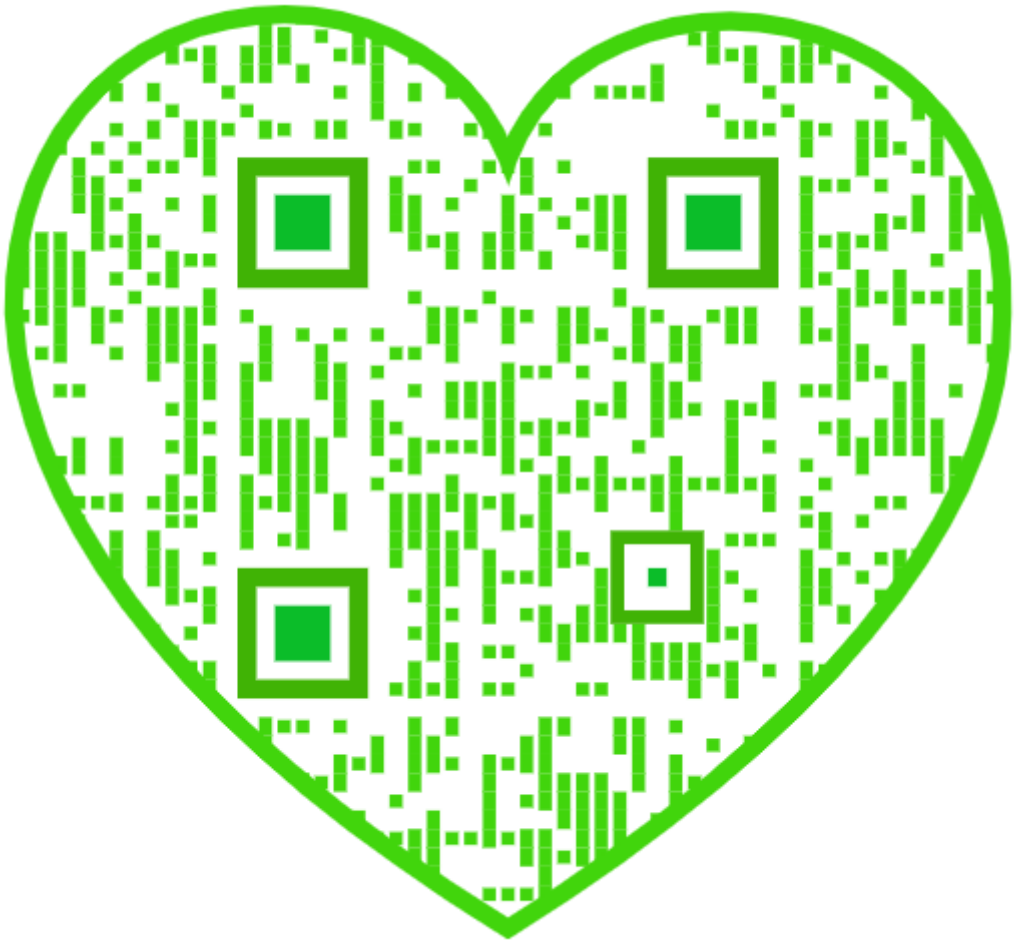

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CHEAP TELEPHONES.

The expiration of the Bell telephone patents is revolutionizing the sale of telephones in this country. It will be seen by the advertisement of the Metropolitan Telephone Company, of this city, who are licensed under the Bell Telephone Company, that they are now offering the genuine Bell telephone instruments for sale at $1.25 each. As these instruments are accurately made, and yield the best results, they are likely to give a great impetus to the construction of short telephone lines in buildings and in country places.

A NEW STREET CAR MOTOR.

A recent number of the *Morning Call*, San Francisco, contains an account of the trial in that city of a gasoline car, the invention of Daniel S. Regan. The propulsion of the car is effected by the injection into the engine cylinder of a small quantity of gasoline, the vapor of which is mixed with air, forming an explosive mixture that is fired by electricity. A pressure of 280 pounds per square inch is produced on the piston. The trial car is said to have operated with great success, demonstrating an economy and ease of working altogether superior to anything in the line of street car motors that has yet made its appearance. The *Call* says a reward of £50,000, or $250,000, has been offered in England for the production of a new form of street car propulsion that shall be better than the overhead trolley or the cable system. But this, we think, must be an error. The only reward offered in this direction, so far as we know, is that of the Metropolitan Traction Company, of this city, who offer to pay a reward of $50,000 for a new system that shall be approved by the New York State Board of Railway Commissioners, as being superior for practical uses in the streets of New York to the cable or the overhead trolley.

THE CALIFORNIA MIDWINTER EXPOSITION IN GOLDEN GATE PARK, SAN FRANCISCO.

On May 31, 1893, in the city of Chicago, a meeting was held in the rooms of the California Club and the suggestion was made by Mr. M. H. De Young, vice-president of the Columbian World's Fair, that a midwinter exposition should be held in San Francisco, California. The idea was acted on, and the next day the announcement was made. Work at once began in the appointment of officers, enlistment of State and city recognition, and in the soliciting of subscriptions. Nearly half a million of dollars was soon obtained. The ground was broken in San Francisco on August 24, in the presence of a concourse of nearly 100,000 people. The work progressed rapidly. Advantage was taken of the Chicago Fair, and exhibits and attractions therefrom were secured. Six main buildings, distributed over nearly 200 acres of ground, lighted by 1,000 electric lamps and 15,000 incandescent lamps from Chicago, one hundred independent buildings, are some of the elements which unite to form what is termed the third most important exhibition the world has ever seen.

The fair grounds are situated in Golden Gate Park, San Francisco, the park being now in its best state, with its semi-tropical trees and plants, the lovely climate adding to the charms of the locality, which forms a setting for the architectural features. For by the use of staff beautiful buildings have been rapidly erected, and the system of the Chicago Fair has been followed in keeping in view the architectural elements of the scene. The cost of the fair, it is thought, will not exceed $1,500,000, nearly half of which has been contributed by the people of San Francisco. As the Chicago Fair was termed the "White City," the name of Palm City has been bestowed on its western sister. The fair opened on Saturday, January 27, with due ceremonies and in the presence of an immense audience.

Speeches, a grand parade, concerts, and at night fireworks and illuminations made the occasion a memorable one. The admissions on that day aggregated 72,248 people.

Throughout the grounds are distributed every imaginable attraction, the Firth wheel, the scenic railway, the cascade, foreign villages and the like, entertaining, and in some cases instructing, the visitors. A reproduction by cyclorama of the Hawaiian volcano Kilauea is described as wonderfully realistic.

The fair is managed by the following executive committee: M. H. De Young, president and director-general; Irwin C. Stump, vice-president; P. N. Lilienthal, treasurer; R. B. Mitchell, A. Andrews, F. G. Berry, Eugene Gregory, J. H. Neff, and J. S. Slauson, of Los Angeles.

Divisional Patent Applications.

A late decision of the Supreme Court involves certain considerations as to patents issued upon divisional applications, the results of which the *Electrical Engineer* thinks are likely to be important and far reaching. Briefly, the doctrine now laid down by the court, as we understand it, is that only one patent can be taken for a single concrete invention, or for any part of such invention; and consequently, that when more than one patent has been issued purporting to cover different parts of the same subject matter, all except the one bearing the lowest serial number are void. Especially is it held by the Court to be inadmissible to distribute the subject matter of an invention between two patents, distinguishable from each other only by the different functions ascribed to a common mechanical structure.

We entertain no doubt that the ultimate effect of this decision will be wholesome and salutary. As to its immediate effect, there is certainly abundant room for interesting speculation. One important patent may be mentioned, which would seem to be in imminent danger of being overthrown by the new doctrine—the famous Berliner transmitter patent, which, in reality, covers the employment, as a transmitter, of a certain mechanical structure which, in its capacity as a receiver, was patented as long ago as November 2, 1880. There are also a very large number of patents on electric railway apparatus and devices, heretofore assumed by their owners to be controlling, and upon which a considerable number of pending suits have been based. which are founded upon divisional patents Some of these, at least, must unquestionably be obnoxious to the doctrine now laid down by the Supreme Court.

Compound Glass.

According to a report of the technical glass laboratory at Jena, O. Schott has introduced a glass which is of great technical interest and value. It is free from alkali, but can be worked before the blowpipe, has a small co-efficient of expansion, and is distinguished by many excellent qualities. Hitherto the view has been generally held that good glass must contain, together with silica and a divalent or trivalent metallic oxide, the oxide of a monovalent metal (an alkali metal or thallium). By the glass referred to (121^{III}) is free from alkalies and has the following composition:

BaO=25 per cent., ZnO=5 per cent., Al_2O_3=4·5 per cent., B_2O_3=14 per cent., Mn_2O_3=0·08 per cent., SiO_2=51·22, As_2O_5=0·2 per cent.

Schott was led to the production of his compound glass (*Verbundglas*) by studying the state of strain in ordinary glass vessels and tubes cooled in contact with the air. A hollow glass vessel cooled in contact with the air has its outer skin in a state of compression, whereas the inside is in a state of tension; hence it is easily damaged on the inside, but is resistent on the outside. A hollow glass vessel, if introduced when cold into warm air, has its outer skin thrown into a state of compression; if, when it is hot, it is exposed to cold air its outer skin is thrown into a state of tension. This is the reason why cold air causes glass to crack more readily than hot air does. Schott succeeded in throwing the outer layer into a permanent state of compression by covering the glass vessel with a thin outer layer of glass which has a small co-efficient of expansion. The flasks made of this compound glass can be filled with boiling aniline and immediately sprinkled on the outside with cold water; and glass dishes can be heated over the naked Bunsen flame without cracking. Pressure tubes of this compound glass can be made to meet all the requirements of practice. They have been kept in continuous use on locomotives for five months, and when heated to 200° C., they can be sprinkled with cold water without any fear of cracking.

Incandescent Gas Lights.

According to a paragraph in a recent number of the *Journal für Gasbeleuchtung*, a trial has been going on since June last in the Badgasse, Budapesth, and since October in the Ofen Tunnel, with Dr. Auer's incandescent gas lights. So satisfactory is the effect, that when the Budget estimates come on for discussion, it is intended to put forward a request that all streets in which the electric light is not to be used shall be lighted by the incandescent gas system, as by it the amount of illumination afforded is increased by five or even six fold. In Agram also Dr. Auer's burners have been tried with equally favorable results. While under the old system each 630 square meters of street surface received light equal to only 32 candles, every 300 square meters of surface is now illuminated to the extent of 100 candles. The lighting, therefore, is more than six times as great as that ordinarily employed for streets.

The Maxim Gun in Action.

The Maxim gun has been well tested in the Matabeleland campaign. In the skirmish of October 25 the Maxim gun effectually checked the natives. Although the natives were armed with Martini-Henry and Winchester rifles, they were powerless before the terrible fire of the Maxim gun; which mowed them down like wheat before a scythe. In the morning the sight was terrible, bodies being literally torn to pieces by the shot. Each time the natives approached they were quickly repulsed with the aid of the machine gun. The Armstrong 7-pounder has also rendered efficient service in the campaign. On one occasion a shell dropped harmlessly upon the ground, when the negroes immediately began firing upon it. The shell then exploded, killing several.

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The Armies of Europe.

The military statistics of the European nations supply a suggestive object lesson in relation to our present civilization. The importance of the war footing of Europe cannot be overestimated. In case of a general war, the principal belligerent nations of Europe, excluding Turkey, could hurl 14,991,000 men into the contest. The standing army alone of the greater European nations consists of 3,274,000 men. Russia leads the list; her "peace footing" or standing army consists of 868,000 men. These soldiers are drawn from a population of 124,000,000. The enormous strength of this army may be shown by comparing it with the army of Rome during the palmy days of the empire. The permanent military force of Rome on sea and land was only 450,000. France comes next to Russia, the strength of the army being 600,000 men. This army is drawn from and charged upon a population of 38,500,000. The Chauvinistic spirit of the French people has been somewhat modified by the increased permanent military force of Germany, which now numbers 596,000 men, drawn from a population of 49,000,000. Austria, with Hungary, comes next, the army numbering 326,000 men, the population of the monarchy being 41,000,000. Fifth on the list comes Italy, whose armies number 247,000 men, drawn from a populaton of 30,000,000. England, notwithstanding her naval superiority, comes only sixth on the list, the population being 30,000,000 and the standing army 247,000. Spain has an army of 115,000 men, drawn from a population of 17,500,000.

With the size of the country the size of the army gradually decreases until the pitiful handfuls of men are reached who form the armies of Andorra, San Marino, and Monaco. Switzerland is an exception, as the constitution of this tight little republic forbids the maintenance of a standing army. When the "war footing" is considered, Germany leads with 4,000,000 men. Russia, which has the largest standing army, takes a second place as regards the war force, as she can only muster 2,530,000 men. France, with 2,500,000 men, is not far behind. If the size of the war footing of France and Germany be compared with the population, it will be seen that France, taking population for population, is a little ahead of Germany in preparing her whole available material for war. The war strength of Austria-Hungary is 1,753,000 men; that of Italy, 1,650,000 men, while Spain comes next, with 1,083,000 men and Great Britain follows with only 713,000. Switzerland, in case of necessity, can furnish 485,000 trained men.

War is constantly becoming more expensive, and while the war cloud of Europe is settling down, the financiers of the great powers are looking with great apprehension at the cost of throwing armies into the field composed of millions of men. Emperor William will do well to increase his war fund locked in the Juliusturm of Spandau if 4,000,000 of men are mobilized, as 120,000,000 marks will not last long at the present average expense of armies. The statement which is sometimes made that the fortunes of war are decided behind the green baize doors of bankers' private offices contains more truth than is at first apparent. War is now a luxury, and, like all luxuries, can only be enjoyed at great expense. The fact of the expense connected with modern war has made it unattainable to a bankrupt country, and undoubtedly tends to make even the great powers think twice before leaping. Anything which helps to discourage war and favors the settlement of difficulties by pacific means should be encouraged, so that increase in the production of war material may be regarded as a step in the right direction.

What Shall we Eat?

Every once in a while there is recrudescence of vegetarianism and also many reappearances of special recommendations as to diet that are so extreme, not to say "cranky," as to suggest that the persons making them must have spoken out of the sufferings of stomachs so far from normal as rightly to be called "cranky."

The traveler from a distant planet, returning to his home and describing our habits, would say: "They prey upon other animals." It has a repulsive sound; but, of course, it is just what meat-eaters do, in spite of all the refinements and transformations that, as Emerson says, "intervene between the slaughter house and our plates," where the slice of steak or roast reposes so tranquilly as to give no hint that it was once alive and as full of sensitive nerves as is the mouse on which the cat so ruthlessly pounces.

But let even the hypersensitive founders of the Society for the Prevention of Cruelty to Animals reflect a moment, and ask themselves if the deliberate killing of an animal, by intelligent and humane methods, is not a more merciful fate than the slow perishing by disease or old age, which certainly would occur in a state of unassisted nature.

At the two large abattoirs of Lyons, France, the guards protect the animals to be slaughtered from seeing anything connected with the slaughtering of other animals, as terror is found to have an injurious effect upon the secretions and flesh of dumb creatures. Zurich, in Switzerland, twenty years ago, invented a merciful way of killing cattle; a leathern strap completely covering the eyes is slipped over the animal's horns before he is taken to the slaughter house. In the center of this strap is a perforated iron block, the hole being directly over the center of the forehead. Standing in this hole is a short, sharp, hollow steel spike, which is driven into the brain by a single blow of a heavy hammer, producing instant unconsciousness. Immediately, a sharp iron rod is made to penetrate that point in the base of the brain which corresponds to the "vital knot" of the human system, and absolute death is the result. The large blood vessels are then severed. As civilization advances, we see everywhere more humane laws being enacted for what must be considered the *indispensable killing of animals*, if man is to continue on his upward career, in knowledge, wisdom and happiness; for the brain worker, far more certainly than the muscle worker, must have flesh food to work upon.

The vegetarian can point to a considerable array of facts that sustain his theory. Many tribes of North American Indians have attained a very high physical development upon a vegetable diet; many Scotch farmers live principally upon oatmeal; meat is a comparative rarity among European laborers. Many Englishmen formerly lived on bread, cheese and beer (though cheese can hardly be called a vegetable); the Roman legionary carried a weight of sixty pounds and performed astounding feats of strength and endurance without eating flesh, and some people have substituted eggs and milk for meat, under the delusion that they are less atrocious than flesh-eaters; but the opinion of the cow whose calf they have robbed of its natural food should be asked, before final judgment.

Dr. C. N. Folsom, then Secretary of the Massachusetts Board of Health, wrote twenty years ago:

"The Brahmins of India eat nothing which contains the germ of animal life, although they can hardly be said to have attained a vigorous physical or mental culture."

Mr. Edison puts the truth here hinted at more tersely in "Those that eat rice think rice," while Dr. Folsom still further says:

"Although physiologists are not agreed that *animal* food is absolutely essential to a high degree of civilization, there are certainly many facts which seem to indicate that it is resolvable into a greater amount of force than the other nitrogenous foods."

That the kind and quality of food gets into a man's thought and disposition is not to be denied. The physicians at Sebastopol, after the Crimean war, testified that when a Russian soldier was intoxicated he became disgustingly maudlin, affectionate and silly, while the Briton in that state became at once "full of fight;" and they accounted for it by the fact that the first lived on black bread and the second had meat. Dogs that are quiet and subdued on vegetable food grow fierce on meat, and there are persons of fine nervous organization who find in meat a stimulus similar to that of wine.

The great advances in analytical chemistry in these last two decades have done much to reveal wherein the "potential energy" of foodstuffs lies, and the "training" of our athletes shows that we are beginning to prescribe food with as much precision as we can use the most familiar drugs—say as quinine and opium.

When James Russell Lowell went out to "rough it" among the Maine lumbermen, he was astonished to find that the essential article of their diet was fat pork, against which he at that time held a genteel prejudice; a few days of heavy tramping brought him to a complete appreciation of its merits as a heat and strength producer. These lumbermen labor intensely in the cold and snows of winter, and in the icy water in spring, and beans and fat pork are the staple of their diet; and the modern chemist comes along with his physiological yardstick and tells us the exact reason why men performing the severest tasks prefer pork to the choicest cuts of beef.

Prof. W. O. Atwater says:

"The energy from the sun is stored in the protein and fats and carbohydrates of food, and the physiologists of to-day are telling us how it is transmuted into the heat that warms our bodies, and into strength for our work and thought."

Professor Frankland determined the heats of combustion of many substances, and reckoned them in units called "calories." Among forty-five substances tested, he found that very fat pork contained an amount represented by 3,452, while fat beef contained 2,750, lean beef 807, and turnips only 139, while beans came up to 1,519, and peas to 1,476. Many of us do not require so much "energy" in our food, but we do need material which will restore the worn-out and ever-wearing-out tissues of the body, and for this we must have foods that contain much protein, and these are beef, some kinds of fish and eggs. All food substances have more or less of water, but the driest of all is fat pork. For a most interesting study of the whole subject, where the relative value of different substances, for nutrition, is shown by an ingenious diagram at a glance, the reader is referred to a series of articles by Prof. W. O. Atwater, in the *Century Magazine*, beginning in May, 1887.

Fortunately, the healthful preparation of food is being studied by our scientists theoretically and by our wide awake, intelligent women practically. Mr. Edward Atkinson truly says:

"If the masses of the people are to be well nourished, each adult person must have the due proportion of protein, or nitrogenous material, of fats, and of carbohydrates, or starchy materials: because, if either one is deficient, vital force cannot be sustained. Neither can there be any true mental vigor or spiritual life when the body is not well nourished."

There has been too much despising of "this vile body," as some have dared to call the exquisitely adjusted temple of the Holy Ghost which God has given into our individual keeping, and for the neglecting or abusing of which he will make inquisition. If we intend to care for the soul, we must first care for the body. He who knew "what was in man" set the example when he saw to it that the multitude was fed before he attempted to instruct them.—*The Independent.*

Coloring Gelatino-Bromide Prints.

The *Archiv* gives the following plan for getting different colors on bromide prints. The prints are feebly developed with eikonogen, fixed, washed and then immersed in a solution of:

Nitrate of lead	4 parts.
Red prussiate	6 "
Water	100 "

This bleaches the image, which may then be colored thus:

Brown.

Schlippe's salt	10 parts.
Ammonia	5 "
Water	150 "

Yellow.

Neutral chromate of potash	4 parts.
Water	100 "

Green.

Immerse the yellow prints in

Iron perchloride	1 part.
Water	10 parts.

Red.

Immerse the yellow prints in

Chloride of copper	1 part.
Water	10 parts.

Nickel Green.

Chloride of nickel	1 part.
Water	10 parts.

Orange.

Mercury bichloride	3 parts.
Potassium iodide	4·5 "
Water	100 "

—*Br. Jour.*

Co-efficients of Expansion of Glass.

Most of the published data relate to glass of unknown composition, and are therefore of comparatively little use. Regnault is the only investigator who appears to have supplied information respecting chemical composition with the physical data; and even his researches do not enable us to draw any conclusion as to the influence of different oxides upon the expansion of glass. A careful and extensive investigation of the co-efficients of expansion of a large number of glasses of various compositions (made by the Jena firm) have been carried out by Prof. Winkelmann, Dr. Straubel, and Dr. Pulfrich, using a dilatometer according to Fizeau's method as modified by Abbe (Wied. Ann. 38, 453). The tabulated data occupy the best part of three large pages, and the principal results can only be given here. Of these the most striking is the predominating influence of alkalies upon the value of the co-efficient of expansion. By increasing the amount of alkali in a glass, its co-efficient of expansion could be increased until it approximated nearly to that of nickel or iron. The tables further show that the expansion of different glasses for equal intervals of temperature varies within much wider limits than has hitherto been believed; for example, a specimen of glass containing 12 per cent of alumina was found to have a co-efficient of expansion 0·00003369; whereas a specimen of zinc borate glass free from alkali has a co-efficient of expansion of only 0·00001097. In the case of the usual silicate glass it is found that metallic oxides, such as zinc oxide, alumina, lead oxide, and baryta, do not produce any considerable increase in the expansion. Phosphate glass behaves much like the ordinary silicate glass with respect to expansion, whereas borate glass is distinguished by a low co-efficient of expansion.

Artificial Stone.

Thirty parts of tin are dissolved in 40 parts of muriatic acid and 30 parts of sal ammoniac are added. A powder composed of freestone 50 parts, zinc oxide 20 parts, pounded glass 15 parts, powdered marble 10 parts and calcined magnesia 5 parts is prepared and made into a paste with the liquid above mentioned. Coloring matter may be added. The composition may be used as a damp-proof coating for walls or for repairing stone work or for moulding statues or ornaments.

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THE BOYNTON BICYCLE ELECTRIC RAILWAY.

(*Continued from first page.*)

tice to run trains of mixed trailing and motor cars, vestibuled throughout, with the front end of the front motor car and rear end of the rear motor car sharp. Each compartment has a side door.

The car is carried by two wheels. Each wheel is journaled in a frame at the bottom of a vertical shaft or column rising through the car roof. The upper end of this column carries a frame with four guide wheels, which have vertical axes, and between which is space for the upper guide rails. In passing around curves these four rollers turn the column, so that the axis of the large wheel is always normal to the curve. The wheel has only to turn through a small arc; the opening in the floor of the car is large enough to permit this rotation, and four centering rollers, with horizontal axes, and distributed approximately at right angles to each other about the perimeter of the determined circle, press against bearing pieces, which arrangement keeps the spindle centered at its lower end. The car body swings on springs from the two columns. The springs are fastened near the level of top of the car. Thus the car body can spring up and down without affecting the columns and wheels. This is shown in Figs. 2, 5, and 7.

Fig. 3 is a view of the motor and driving wheel. The motor is of the Gramme type; the field, in part broken away, is seen with four of its coils of wire; back of it is seen the Gramme ring with its connections to the commutator and the brushes. The Gramme ring is bolted to the wheel; the field is carried by the stationary framework. When excited, therefore, the wheel and Gramme ring rotate, the field not moving. A six-pole motor, with armature forty-three inches in diameter, placed on a five-foot wheel, and developing about 75 horse power, is a standard assigned by the inventor, and is employed on the car shown. The torque has a lever arm of about twenty inches.

On reference to Fig. 2, it will be seen that there is an upper rail to act as a conductor for the current. This cut shows also the two horizontal guide wheels which are to bear against the wooden beams between which the current rail is placed. This current rail weighs 12 pounds to the yard and is of 1¼ square inches section. With its casing it is shown in Fig. 4, where also are seen the guide beams.

In Fig. 5 is shown an interior view of the motor compartment, with the wheel and motor, the frame for the same, and the spring bearing for the car body.

Fig. 6 shows the electric plant as at present installed, with the switchboard, steam engine and four-pole 100 H. P. Westinghouse dynamo.

The whole driving structure which we have thus far described is shown in Fig. 7, and after what has been said, the cut will be found self-explanatory. In it is seen the driving wheel with the armature fastened to it, actuated by the field, which is shown in this case placed within the circle of the Gramme ring. The reversing switch and resistance box for controlling the speed are also shown. It will be seen that the current reaches the top rail: thence is taken to the motor by a collector, and passes away therefrom by the bottom rail on the return circuit to the dynamo.

In Fig. 8 is shown a collecting device for taking current from the upper rail. At present frictional shoes are used instead of the brush shown. This shows very distinctly one of the guide wheels. It is an interesting fact that in operation these wheels have very little to do, in many cases light being visible between their periphery and the beam which they are supposed to bear against. It has been found that soft rubber bands sprung around the steel wheels have not worn through with 4,000 miles of travel.

In Fig. 9 is shown the station near Patchogue, L. I., with a car ready to start out on its travels, this time on a surface road. The great cheapness of the construction and the high velocity to be employed has induced the company to feel that an elevated road is the more expedient, and the larger cut shows the ideal elevated bicycle road. The sharp-pointed car carried by two wheels and moving at the rate of 70 to 100 or more miles per hour, abolishing grade crossings and electric trolley wires, here appears in operation.

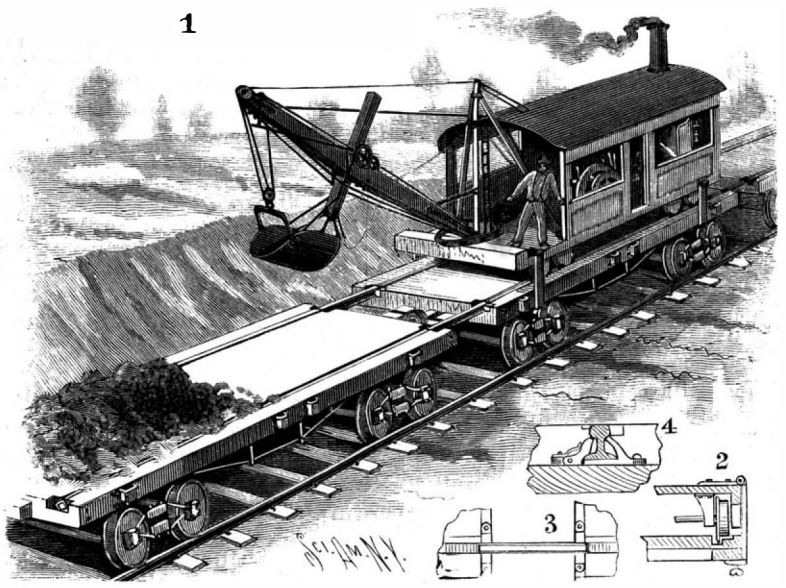
Some of the generalities of the system may be spoken of now. A motor car seating twenty-four people will weigh 6 tons, and the trailing car seating fifty people will weigh half this amount. The cars are 51 feet long, 4 feet wide and 7 feet high. A train of two motor cars with three trailing cars between them, accommodating 200 people, can be built within twenty tons. This is about one-tenth the weight of the Empire State Express, which also seats that number of people.

The maximum curve on the present road is one of nine degrees, and therefore is of only 640 feet radius.

The car in operation runs around this nine degree curve with the greatest ease of motion, the absence of side swaying of the car or passengers being particularly noticeable.

On curves the guide rails are displaced toward the center of curvature, so as to tilt the top of the cars inward. Two feet is the maximum displacement of the upper rails, and is gradually reached before the curve begins, giving a transition curve, so that the car enters the maximum curve with the full inclination. The rule is to give sufficient inclination for the highest speed. The upper rail is so high and the center of gravity so low that the pressure on the guides is very slight. Nine feet now intervenes between the track rail and guide rail.

On the top of the wheel columns is a section of an inverted U beam about four feet long, embracing the guide beam, so that if all the rollers should break, the car will still be maintained in its upright position. A similar arrangement is provided for the supporting wheel, so that if anything breaks, the car end will be carried by a sliding shoe in perfect safety until it stops.



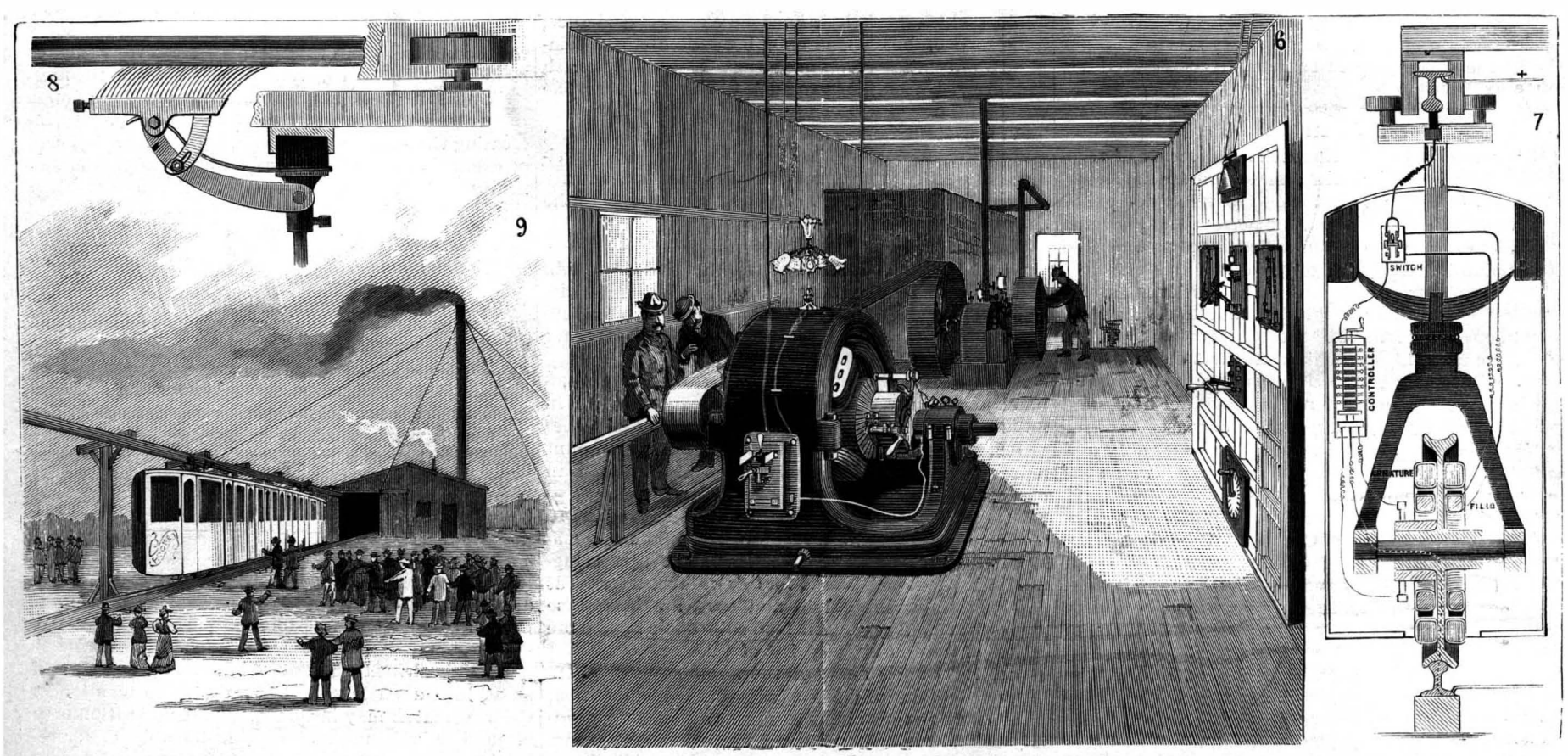
BOUDRIE & McMANUS' STEAM SHOVEL.

A STEAM SHOVEL FOR USE ON FLAT CARS.

To provide a platform for the shovel carriage whereby it may be readily moved from end to end of a train of cars, and the work of loading a train be thereby greatly facilitated, is the principal object of the invention herewith illustrated, which has been patented by Messrs. J. M. Boudrie and Thomas McManus, Rulo, Neb. Fig. 1 represents the improvement in use, Fig. 2 showing the clamping of the shovel carriage to the flat car, and Figs. 3 and 4 illustrating the track connection between two cars. In grooves or channels in the floor of each car are tracks, preferably of angle iron, and in the sill at the end of each rail is a transverse recess in which is a chair, the opposing chairs of meeting cars, or on the two ends of a car, being slightly different. In the one case the chair consists of a base plate with rigid curved arms at each side of the center, adapted to bear upon the web and base of a rail inserted between them, while in the other case one of the curved arms is pivoted, and held normally in closed position against the rail by a spring. When the cars are coupled together, the tracks are rendered continuous from one end of the train to the other by short coupling rails whose ends are seated in the chairs, the pivoted arm of one of the chairs being raised against the pressure of the spring to facilitate the insertion of the rail. The shovel carriage is mounted on flanged wheels adapted to travel on the tracks, and carries a motor, mast, and hoisting machinery of any approved description, the carriage being firmly held to the car upon which it is located by brackets of a clamp form, hinged to the side edges of the carriage. The lower end of each clamping bracket has a set screw by which the clamps are held in clamping position, they being thrown upon the floor of the carriage when not needed.

Chemicalized Flour.

In order to render fine white wheaten flour equal in digestive and nutritive value to brown or whole meal, without introducing any of the bad qualities of the latter, the inventor mixes with it one-quarter per cent each of magnesium phosphate and sulphate.—*W. Jones.*



THE BOYNTON BICYCLE RAILROAD—DETAILS OF TRACK, MOTOR, AND CAR CONSTRUCTION.

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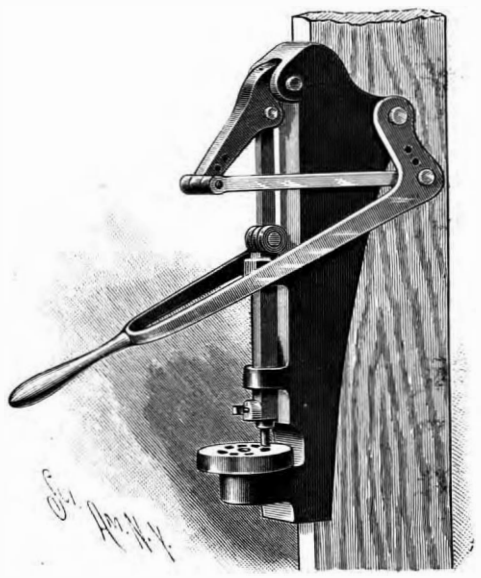
A HAND PUNCH FOR WORK ON COLD IRON.

This is a strong and simple machine in which levers are so arranged as to be operated by hand, practically without friction and with great power, for punching holes in metal. The improvement has been patented by Mr. Paul L. Johnson, of Bishop Hill, Ill. The frame is clamped to a suitable support and has at its lower end a lug which carries the die plate. The latter may, if desired, be held in place by a downwardly extending bolt and thumb nut. The vertically sliding punch bar is pivoted at its upper end to a drive bar, and the latter is pivoted at its upper end to a drive lever, the short arm of which is pivoted between lugs near the top of the frame, while its long arm, near the outer end, is connected by rods which straddle the frame with the elbow portion of a forked-handle lever, which also straddles the frame and the drive bar, the short arm of this lever being also fulcrumed to the frame. The handle lever and the drive lever each have a series of holes to receive the pivot pins of the connecting rods for the making of different adjustments, according to the length of stroke or the power required.



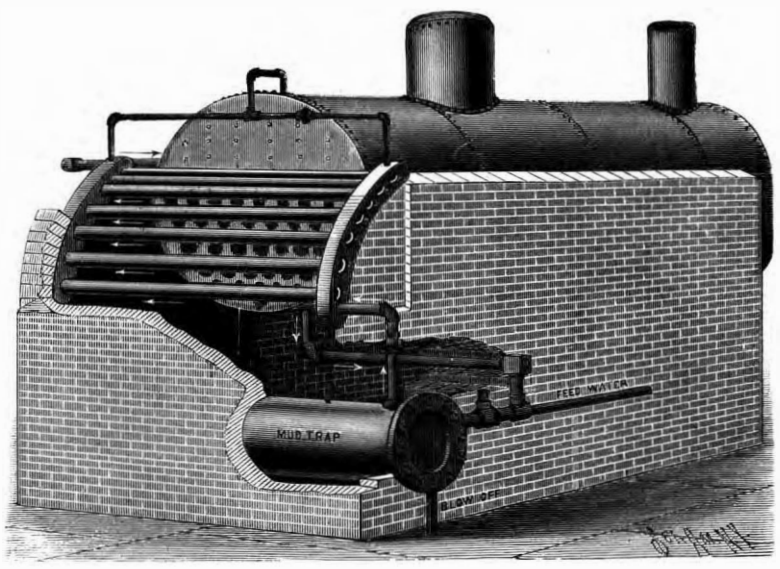
JOHNSON'S PUNCHING MACHINE.

What is Carbon?

That carbon is a "metalloid"—which, if it means anything, means something resembling, but not identical with, a metal — we have long been assured, chiefly by French chemists suffering from an excess of system. Now, however, it has advanced a step further, and presumably forms a basic oxide. No other hypothesis appears tenable to account for the existence of two remarkable bodies named respectively "carbon silicate" and "carbon sulphate," the product of the reaction of ignorance and printer's ink found in a column serving for the fractional distillation of "scientific" residues, which appears weekly in an evening paper. Chemists will be disappointed to learn that the first named substance is nothing more mysterious than carborundum. They will, however, have ample room for admiration concerning the second, as it is said to be concerned in the production of "coal balls" found in coal measures, and by passage through the vegetable tissues of plants to produce "chemical changes resulting in the formation of carbonate of lime and iron pyrites." We are tempted to suggest that sulphate of iron may be meant, but then, arguing from the carborundum case, carbon sulphate may after all be merely a pseudonym for carbon disulphide. The speculation is enticing, and we commend it to the *dilettanti.—Industries.*

AN ARCH SUPPORT, WATER PURIFIER AND HEATER.

This improvement, adapted for use in connection with an ordinary boiler, affords a permanent arch over the combustion chamber at its back end, and is an auxiliary steam generator as well as feed water heater, while aiding in securing the best results in keeping the boiler practically clean, by blowing off and otherwise. It has been patented by Mr. George W. Collin, of Atlanta, Ga. The heater is formed with curved end columns and connecting pipes, the latter having in their ends hand holes with removable cover plates, the heater being supported by the furnace walls and forming a firm support for the arch, which may be built directly upon the end columns and tubes. In each of the connecting tubes is a strip of sheet copper with serrated edges, to take up lime, etc., from the water, and prevent the formation of scale, the mud drum also being supplied with a similar plate, and the plates being readily removable when necessary. At its upper end the heater is connected by suitable pipes with the steam space of the boiler, and one of its curved end columns is connected near its upper end with the boiler at or just below the lower water line. The feed pipe has a valved connection leading to the bottom of the boiler and another leading to the mud drum, while the latter is also connected by a valved pipe with one of the curved end columns of the heater, and has a valved escape or discharge pipe. When the boiler is filled and the fire started, the valve in the pipe connecting the mud drum with the heater is opened, and the heat and flame passing backward under the boiler, up against the pipes of the heater, causes a circulation of water from the upper connection of the heater into the boiler, and from the bottom of the boiler through the mud drum and again into the heater, making a constant current one way through the device. When feeding water from the feed pipe, the water is first forced into the mud drum, to be taken up by the current through the heater, thus passing into the boiler at a high temperature, the steam which is formed passing into the steam space of the boiler. To blow off water from the bottom of the boiler, the valves in the feed pipe and in the pipe connecting the mud drum with the heater are closed.



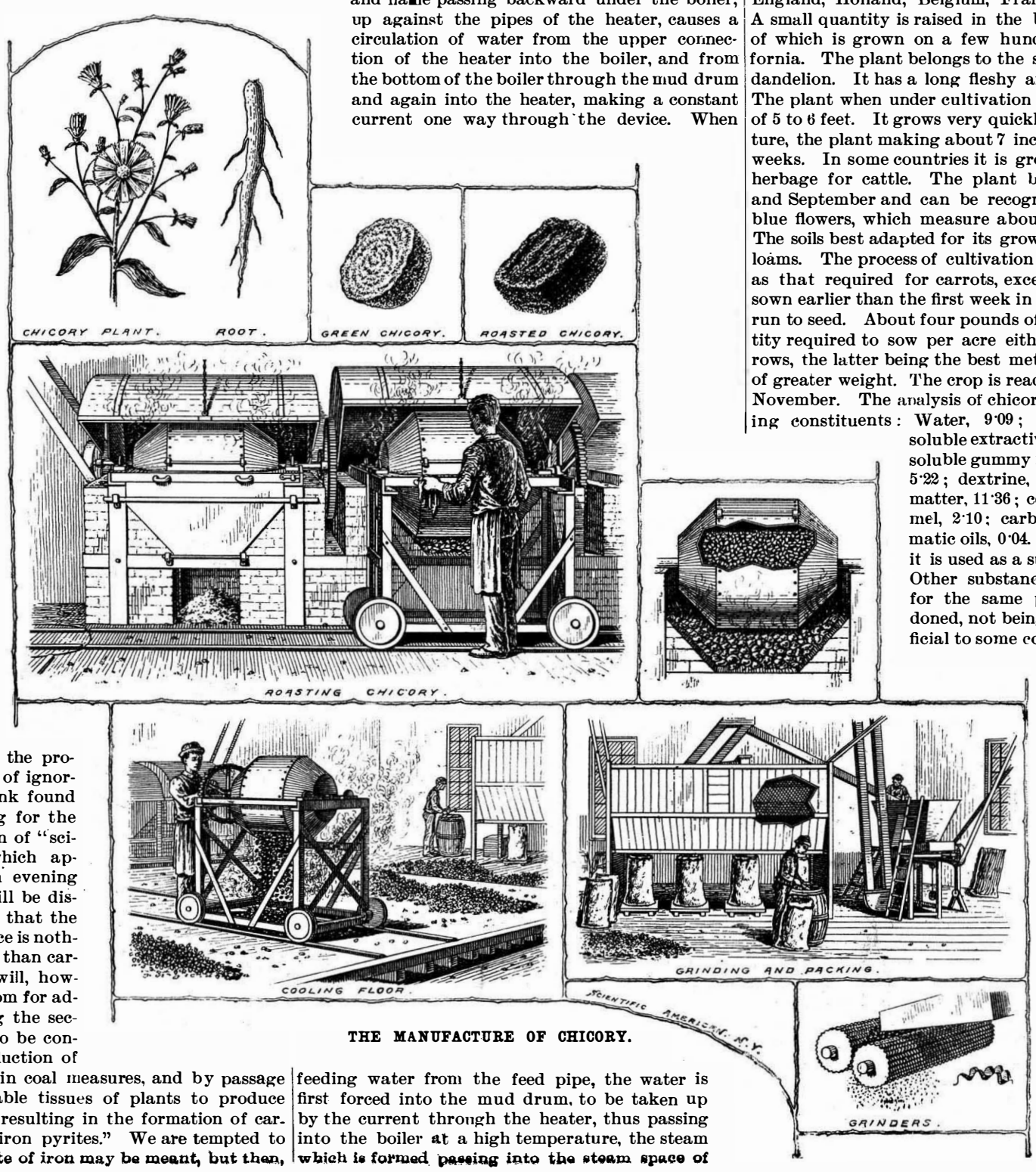
THE "C. B." BOILER ATTACHMENT.

Marble-like Plaster.

Zinc in the form of cuttings or dust is placed in water, and after having been allowed to stand for some time boiled therewith, whereby it dissolves to the extent of about 32 milligrammes per liter. The solution is mixed with an equal quantity of a solution of an alkaline silicate, preferably silicate of potash at 3° B., and the mixture diluted with four times its weight of water. One part of gypsum is mixed with two parts of lime and made into a paste with the liquid already described, the product having, it is stated, a marble-like luster due to the employment of the mixture of silicates used.

MANUFACTURE OF CHICORY.

Chicory or succory plant is raised principally in England, Holland, Belgium, France, and Germany. A small quantity is raised in the United States, most of which is grown on a few hundred acres in California. The plant belongs to the same family as the dandelion. It has a long fleshy and milky tap root. The plant when under cultivation grows to the height of 5 to 6 feet. It grows very quickly in a low temperature, the plant making about 7 inches in about three weeks. In some countries it is grown as fodder and herbage for cattle. The plant blossoms in August and September and can be recognized by its bright blue flowers, which measure about 1½ inches across. The soils best adapted for its growth are deep, friable loams. The process of cultivation is about the same as that required for carrots, excepting that it is not sown earlier than the first week in May, lest it should run to seed. About four pounds of seed is the quantity required to sow per acre either broadcast or in rows, the latter being the best method, yielding roots of greater weight. The crop is ready for digging up in November. The analysis of chicory shows the following constituents: Water, 9·09; soluble salts, 4·20; soluble extractive substances, 41·29; soluble gummy resinous substances, 5·22; dextrine, 6·12; saccharine matter, 11·36; cellulose, 19·40; caramel, 2·10; carbon, 1·18; empyreumatic oils, 0·04. In some countries it is used as a substitute for coffee. Other substances have been tried for the same purpose and abandoned, not being agreeable or beneficial to some constitutions. When mixed with coffee it adds to it additional color, bitterness and body. For the preparation of chicory the older, stout, white roots are selected, and after washing they are sliced up into small pieces and kiln-dried. In this condition it is sold to the chicory roaster. The roasters are made of rolled steel about 3 feet in diameter, about 3 feet in length and tapering down to about 1 foot at the ends. They are drawn from the ovens, on a track



THE MANUFACTURE OF CHICORY.

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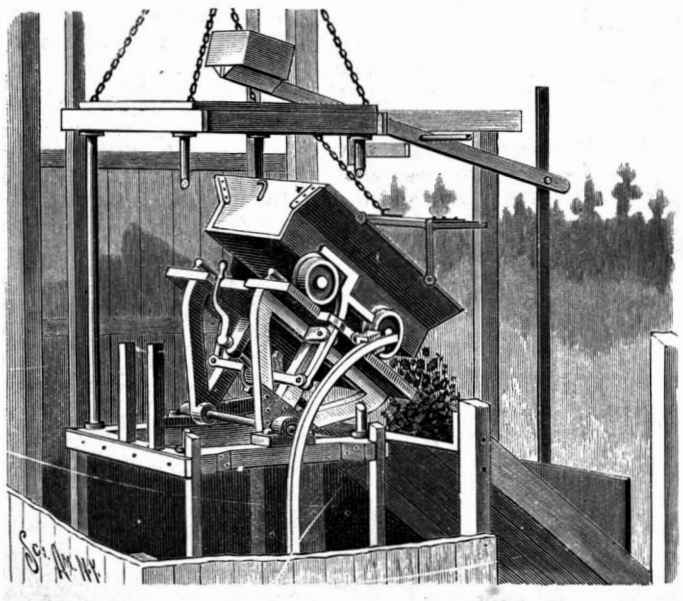
fitted up on each side, by means of movable frames in which they revolve. At one end of each roaster shaft is a gearing wheel which connects with a piece of shafting running the length of the ovens in the rear. This wheel geared to another on the rear shaft causes the roaster to revolve. From 200 to 400 pounds of dried chicory is put into a roaster with a quantity of olive oil or fat to prevent it from burning, where it revolves over a coke fire for about 1¾ hours, at the rate of 12 to 16 revolutions per minute. An iron carriage running on a track is then wheeled directly in front of the oven; the iron frame with roaster is then drawn from the oven on to the carriage, which is the same height and width as frame, and then wheeled away to the cooling floor, where the roaster is emptied and refilled again with dried chicory and run back over the track again to the oven, where it is replaced over the fire. The cooling floor is made of brick or cement and is about 30 feet square. After cooling, the chicory is put into the grinding machine. The material passes down through a hopper and between the teeth of a number of 8-inch rolls, which crush and grind the material into small particles, which is then conveyed by means of traveling cups to a wire bolt. The bolt is about 20 feet in length, the meshes of which run from about 4 to 40 to the inch. The ground material passes into this bolt, which revolves at the rate of 28 to 30 revolutions per minute, separating the fine particles from the coarse, which falls or sifts down through the netting to the openings at the bottom, and into the bags below. It is then packed into barrels and is ready for the market. In this country coffee is adulterated with about 2 per cent of chicory. Chicory is imported to this country in 100 to 150 pound bags, the average price being about 2½ cents per pound. Ground chicory brings about 5¼ cents per pound. The annual importation of chicory amounts to about 10,000,000 pounds. In San Joaquin County, California, about 400 acres are raised, furnishing in good years a profit of about $300 per acre. The root when dried brings about $200 per ton. The sketches were taken from the plant of the American Chicory Manufacturing Company, Jersey City.

APPARATUS FOR DUMPING COAL CARS, ETC.

This is a strong and rapidly working apparatus, for use in connection with an ordinary car, to automatically dump the load into a chute when the car has been raised to the required height. It has been patented by Mr. William H. Barrett, of Weir, Kan. The elevator cage is operated by cables in the usual way, and carries a dumping platform mounted on tilting frames, the platform having tracks on which the ordinary dumping car may be run. The car is held in position by swinging clamps on opposite sides of the car, with arms engaging the flanges and faces of the wheels, the clamps being fulcrumed on the sides of the platform, and having lower projecting ends pivoted to connecting rods extending beneath the car to a connection with an eccentric on a shaft journaled in bearings beneath the platform. The latter shaft has levers or arms which project above the platform, and by means of these levers the clamps may be swung in

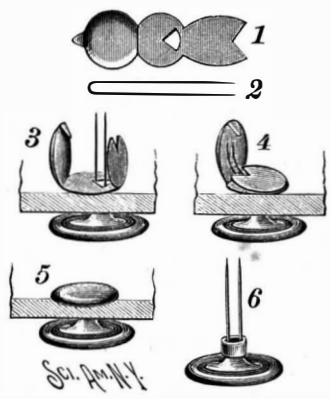


BARRETT'S DUMPING APPARATUS.

or out. The dumping of the car is effected by guides on opposite sides of the elevator well, the guides curving outward toward the chute, and being clasped by shoes on opposite sides of the tilting platform. When the car and the platform are in a horizontal position the rear end of the car rests on posts on the cage, and the load is placed a little behind the center of gravity, so as to keep the car level. The car has at one end a swinging end gate engaged by a chain extending from the top of the cage, whereby the gate will be held up as the car is tilted in dumping, the gate again dropping to place as the car returns to horizontal position. The chute is also provided with a gate supported from the outer end of a lever on the inner end of which is a weight normally holding the gate raised. The inner end of the lever, extending into the elevator well, is lifted by the cage to close the chute at the time that the car is dumped, and the load is thus retained in the chute until the car starts downward, when the weight drops and the gate is lifted to permit the load to pass downward.

AN IMPROVED BUTTON FASTENER.

This is a simple device, readily applied for securing an ordinary style of buttons to garments. It has been patented by Mr. Robert Mowry Bell, of Santa Cruz, Cal. Figs. 1 and 2 show the clamp plate or blank and the fastening wire, Figs. 3 and 4 illustrating



BELL'S BUTTON FASTENER.

progressive stages in applying the fastener, the completed stage being represented in Fig. 5. The fastening wire, in the form of a staple, is passed through two of the holes of the button and through the fabric, a collar being employed as shown in Fig. 6, where desired. The ends of the wire having been passed through the nearly central opening in the clamp plate, the ears at each end of this plate are then folded down upon the central portion, the wire lying in the notch in one ear, and the tongue on the outer edge of the other ear being bent down under the central portion. The invention also provides for some variations in the form of the blanks.

Professor Dewar on Liquid Air.

It is said that Faraday, when he was asked what was the use of certain of his discoveries, retorted with the conundrum, "What is the use of a baby?" Professor Dewar recently, at the Royal Institution, attempted to answer the question in a different way, by showing that liquid air—produced with so great an expenditure of time, skill and money—had distinct uses, although those uses were scientific ones, and were useful only as establishing a basis for new scientific theories or as confirming old ones.

The first scientific hypothesis to which he alluded was that as the metals decrease in temperature so they increase in conductivity; so there was every reason—and the experiments with liquid air had multiplied the number and increased the cogency of these reasons—to suppose that when the temperature of absolute zero of minus 274 deg. C. was reached, then the metals reached the point of absolute conductivity. Next to this the lecturer alluded to the uses to which liquid air had been put in establishing and confirming the refractive indices of oxygen air and nitrogen, and then proceeded to answer a number of interesting (if not burning) scientific questions.

How long, for instance, does it take for the mercury in a Torricellian vacuum to vaporize? It vaporizes at once, as the professor showed by painting the outside of a newly created vacuum bulb with a sponge dipped in liquid air, when it was seen that a tiny mirror of mercury was instantly formed on the glass. Does a low temperature make any difference to the absorption of light by a colored surface? It certainly does. Professor Dewar showed that a surface painted with red oxide of mercury, when cooled by the liquid air, changed its color from bright red to orange. Organic coloring matter changed also, but not so quickly. Had a low temperature any effect upon the conductivity of a vacuum tube? Yes; it had. All the vacuum tubes which Professor Dewar painted with liquid air at once began to resist the passage of electricity through them, because the intense cold froze the vapor, which, though imperceptible and imponderable and otherwise undetectable, nevertheless was an aid to conduction. Does a low temperature increase the cohesive power of metals? It did, as Professor Dewar offered (by the proxy of his indefatigable assistant) to show by experiment to any one who waited till after the lecture.

The tensile stress of iron increased at the temperature of liquid air from thirty-four tons per square inch (at ordinary temperature) to sixty-four tons, and every other metal increased its cohesive qualities similarly. The last experiment but one of the lecture answered decisively the vexed question whether metals increased their magnetic qualities at these low temperatures by showing that an iron bar magnet did so to the extent of 50 per cent. The last experiment of the lecture answered no question in particular, but it was the source of the greatest satisfaction to the professor, and aroused a burst of enthusiasm in his audience, which included much of fashionable and nearly all scientific London. He first liquefied in a test tube some of the air of the room, and then—a *tour de force*—solidified it.—*Daily Graphic, London.*

Cement Mortar.

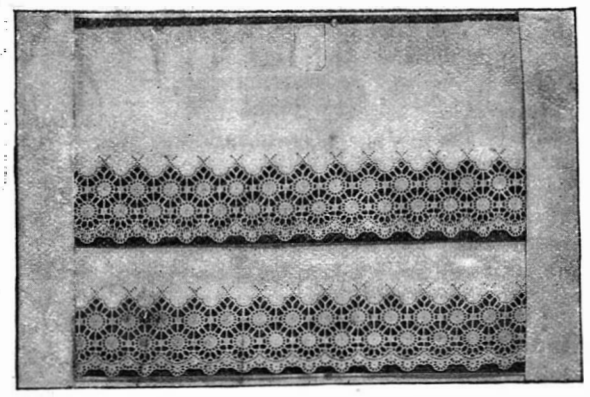
There is a common superstition, which probably retains its hold upon builders, says the *American Architect and Building News*, solely through the profit that they find in maintaining it, but which sometimes really imposes upon laymen, to the effect that cement mortar is improved, in cold weather, by the addition of lime to it. As the mason ingenuously explains to his employer, the heat developed by the lime in slaking keeps the cement warm, and thus prevents it from freezing; and, on this theory, the advent of a frosty day is utilized by multitudes of sharp builders to load the mortar, which they have agreed to make of sand and cement only, with a quantity of lime, which saves cement, and makes the mortar easy to work, but destroys its waterproof qualities and injures its strength and hardness more or less, according to the quantity used. It is hardly necessary to say that the influence of the lime in "warming" the mortar is purely mythical. Lime mortar, without cement, is not much injured by freezing, while cement mortar is totally ruined, so that a mortar containing a large proportion of lime would be harder, after freezing and thawing, than one containing cement only; but it would gain the qualities of lime mortar only as it lost those of cement mortar.

White Dextrine.

A writer in the *Wollen-Gewerbe* states that an entirely white dextrine, perfectly soluble in water, is now prepared by diluting 4 pounds and 6½ ounces nitric acid of 1·4 specific gravity with 317 quarts water in which 2,205 pounds of starch are stirred. This mass is formed into cakes, which are at first dried in the air and afterward at 176° Fahrenheit, and the cakes are then ground and the powder sifted, and heated from 212° to 230° Fahrenheit for one or one and a half hours; in external appearance, this preparation cannot be distinguished from starch flour, and is perfectly free from nitric acid. In the preparation of dextrine in the wet way, with diluted acid, it is remarked that the time at which the last of the starch has been converted into the dextrine must be carefully noted, as the continued influence of the acid causes the dextrine to become rapidly saccharose.

AN ENVELOPE FOR THE DISPLAY OF LACES, ETC.

This envelope is made of paper, cardboard, or other suitable material, in a very simple and inexpensive manner. Its sides are folded over part of the back from end to end, and from the back extend ends which fold over the sides at the ends, the ends having side flaps glued to the under side of the back. Openings or pockets are thus formed at the edges of the sides and ends, so that a portion of each piece of goods held by the envelope will be exposed for examination. The improvement has been patented by Mr. Charles J. Billwiller, Nos. 31 and 33 Walker Street, New York City, and is especially designed to facilitate the display of laces, embroideries, trimmings, and other small goods, the articles being so held that they will



BILLWILLER'S DISPLAY ENVELOPE.

be kept clean and in good condition, and yet permit the retailer to cut off portions as desired.

Sour Bread.

L. Briant has investigated the nature of the acids contained in sour dough, and gives the results of a number of analyses. It appears that the bulk of the acidity of sour dough is due to lactic acid, but that a certain proportion, varying from one-third to one-fifth, consists of acetic acid, while in most cases the amount of butyric acid present is very small. In a future paper the author purposes dealing with the causes which lead to the production of sour bread.

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The Bell Telephone Company.

To an inquirer about Bell Telephone Company earnings the Boston *Transcript* gives the following figures:

	Net income.	Year's increase.	Per cent gain.
1885	$1,809,996.48	.....	....
1886	1,973,350.76	$163,354.28	9·0
1887	2,237,608.12	264.257.36	13·3
1888	2,436,463.56	198,855.44	8·9
1889	2,661,888.69	225,425.13	9·25
1890	2,869,418.35	207,529.66	7·8
1891	3,126,819.90	257,401.55	8·97
1892	3,411,679.78	284,854.88	9·11

It was figured that an increase of 9 per cent in 1893 would be tantamount to earning some 19 per cent on the whole $20,000,000 capital, although all of the new stock did not participate in all of the 1893 dividends. Here is another table of interest:

	Surplus earnings applicable to dividends.	Equals on stock per cent.
1885	$1,809,996.48	18·09
1886	1,973,350.76	19·73
1887	2,237,608.12	20·8
1888	2,436,463.56	24·25
1889	2,661,888,69	26·72
1890	2,869,418.35	22·95
1891	3,126,819.90	20·85
1892	3,411,674.78	19·49

The following is from a recent compilation of the *Boston Herald:*

The present company was organized in May, 1880, with an authorized capital of $10,000,000, and issued capital of $6,500,000. This was increased to $7,350,000 by giving a right to the National Bell Telephone Co.'s shareholders to subscribe for $850,000 stock at par. From that day until recently subscription privileges at par have been issued, and sundry extra and valuable rights have been given to shareholders. None of these is included here. The National Bell Telephone Company had a capital stock of $700,000. When it concluded to reorganize as the American Bell, it sold 500 shares in its treasury for $600 per share to meet its "immediate wants," presumably floating debt. It then gave each shareholder six shares for one and turned the property over to the new company for $6,500,000, taking pay in stock at par. The first year ended Feb. 28, 1880, and included two months of the National Bell year. In 1884 the fiscal year was changed to the calendar year, and covered but ten months. The total dividend payments and capital at the end of each year have been:

	Dividends.	Capital.
1880-81	$178,500	$7,350,000
1881-82	416,500	7,350,000
1882-83	595,000	7,350,000
1883-84	1,051,479	9,602,000
1884	1,440,315	9,602,000
1885	1,562,236	9,802,100
1886	1,568,336	9,802,100
1887	1,568,336	9,802,100
1888	1,789,878	9,962,100
1889	1,838,913	11,303,900
1890	2,213,913	12,500,000
1891	2,625,000	15,000,000
1892	2,919,080	17,500,000
1893	*3,337,500	20,000,000
Total	$23,106,096	.....
Average per year	1,650,435	$11,209,035

* Estimated.

The company began paying extra dividends in 1884. They are included above, and in detail have been: 1884, $288,063; 1885, $392,044; 1886, $392,084; 1887, $392,084; 1888, $597,726; 1889, $600,000; 1890, $750,000; 1891, $900,000; 1892, $991,863; 1893, $1,125,000. The average regular and extra dividend per year has been $1,650,435. The average capital has been $11,209,035. The average rate of dividend has been 14·72 per cent.

Nitrate Deposits in Colombia.

In the December *Bulletin of the Bureau of the American Republics*, Mr. C. F. Z. Caracristi, C.E., gives the following report on the nitrate beds of the Val du Par, lying between the spur mountains of the Sierra Nevada de Santa Marta, in the Department of Magdalena, Republic of Colombia, South America.

The nitrate beds of Chile and Peru have, for a number of years, been coveted as properties of vast value, and have added not only to the wealth of the operators, but to that of the country in which they are found. "Potassium niter" is found in caves mixed with the stalagmitic formations that cover the walls and floor, and in this form was much sought for in the earlier days of American civilization. It was used then, as now, in the manufacture of gunpowder, and formed quite an industry, which has since disappeared; yet in India, where labor is cheap, the collection of sedimentary "saltpeter" continues. In the same country it is also obtained in large quantities, for exportation, by the evaporation of nitrogenous water collected from "seeps," after the same manner as salt is produced.

The niter produced in Chile, however, differs from the sedimentary nitrate, and is known in mineralogy as "nitrotine," or soda niter, and its component parts are nitrogen pentoxide 61·891 per cent, sodium (soda) 38·109 per cent = 100 per cent. It somewhat resembles niter (saltpeter), but more readily deliquefies and burns on coals with a yellow flame.

In the district of Tarapaca, a Peruvian province now occupied by Chile, it is found in the dry *pampas* extending over forty-five leagues. Here it is mixed with sodium bichloride (common salt), magnesium carbonate and shells of very recent origin. This nitrotine is converted into regular niter, or saltpeter, by the displacement of the sodium and the addition of the required amount of potassium. It is also found and worked in the great desert of Acatama, Chile; but in these regions it is found as an incrustation in the earth of decomposed porphyritic rock, and was doubtlessly of feldsparic and calcium origin. No shells are present, and no sign of sedimentary action is here visible. These beds have, of late years, attracted great attention, although they lie at a considerable distance from transportation. Nitrate is used largely in the industrial arts, is a splendid fertilizing medium, and is the base of nearly all known explosives, because the nitrogen pentoxide stands in mutual repulsion with all other substances. And while its atoms will readily combine with atoms of other bases, the least chemical convulsion will instantaneously bring about a separation of the two or more bases and produce explosion. It is the explosive base of gunpowder, guncotton, nitro-glycerine, americanite, giant powder, etc.

The nitrate deposits I discovered in Colombia are of a nature identical with those of Chile, and I have but little doubt that thorough exploration would show the deposits to be almost as extensive as those of that country. My own investigation showed the existence of about thirty miles square of nitrate beds, having a thickness of from one to ten feet.

The stratum carrying this niter is a bed of slaty gypsum (calcium sulphate), in which are embedded large quantities of shells (calcium carbonate), iron oxide, salt, and magnesia. The vein lies at a depth of from eight to twenty feet below the surface, and rests upon the carboniferous sandstone of the region. It is very evident that the deposit is of recent date, and that the nitrate was produced by the chemical reaction of vegetable and other substances operating on the lime in its various forms. The only visible difference between the nitrate of Colombia and Chile is that the nitrification has, in part, been produced by the phenomenal functions of the microscopic plant which is closely allied to the "bacteria" so common to the cave and Indian niter.

I would estimate the visible supply at over 7,372,800,000 tons of nitrate material, assaying from 1 to 13·50 per cent nitrate.

The carboniferous sandstone has prevented the filtration of the niter, and the gypsum has, in part, been a protection to the substance. The niter itself is of a yellowish or light brown color and is found in crustations between the slaty layers of calcium sulphate. In its purer state it is of a white color, translucent, micaceous, and arborescent, and sometimes transparent, and having a hardness of 1·96; gravity, 2·01. When crystals are found, the analysis is:

Nitrate of soda	23·90 per cent.
Chloride of soda	34·05 "
Sulphate of calcium	8·46 "
Sulphate of alumina	3·41 "
Magnesia	trace.
Insoluble silica	24·68 "
Water	5·50 "
Total	100·00 "

But the average deposit, taking the vein as it comes without picking or other separation, would give the following average, which I consider very promising from a commercial standpoint:

Niter	11·406 per cent.
Calcium carbonate	32·516 "
Calcium sulphate	20·121 "
Silica	32·412 "
Calcium phosphate	2·500 "
Ferro-oxide	0·025 "
Vegetable matter and salt	1·020 "
Total	100·000

The above shows plainly that the deposit is, in its crude state, a fertilizer of the best quality. The calcium phosphate is fossilized bone. I must also note that large quantities of iron pyrites are to be found in the archaic formation of the adjacent mountain, which give over 42 per cent sulphur and which would make the manufacture of fertilizer in the region a great industry.

The manufacture of nitric acid could also be made an industry of importance and profit.

The deposits lie at a distance of about sixty-five miles from the city of San Juan de la Cienaga and are, in part, on the waters of San Sebastian River, which flows into the great sea level lake of "Cienaga Grande." Navigating communication could be established with the nitrate beds by conducting the waters of the Aracataca River into the San Sebastian. This work would cost not in excess of $5,000, as a canyon already exists connecting the two rivers. By this work a draught of about six feet could be carried from the falls of San Sebastian River to Pueblo Viejio, from which point navigation communications already exist to Barranquilla and Santa Marta. When the Santa Marta Railroad shall be completed to the village of Fundacion, the niter beds will be only half a mile from the road. The road is now in running order from Santa Marta to Rio Frio, and about six miles are graded beyond Rio Frio in the direction of Rio Savilla. This leaves about thirty-five miles of road still to be built, at a cost of $105,000, to which amount the Colombian government, according to its original contract with Senor Don Manuel J. de Mier and his successors, is to contribute about $30,000.

It is quite obvious that the development of the nitrate industry on the Atlantic coast of South America would mean a great saving in the cost of transportation of the article to both Europe and North America, and the American farmer who has to buy fertilizers would be highly benefited by the advantages offered by the niter beds of Colombia. The reduction of the cost of fertilizer has been a question of great moment to the American farmer—so much so that in nearly all the agricultural States legislation has been enacted having in view the reduction of cost and the assurance of the purity of fertilizing compounds.

Investigation, made by State and federal authorities, has proved the fact beyond dispute that the agricultural possibilities of certain localities of the United States are largely restricted and governed by the cost and power of the fertilizer offered for sale. It is, therefore, obvious that the reduction of the cost of niter and other alien fertilizing substances would redound to the great advantage of the American farmer, with whom the question of cheap fertilizer is one of too much importance to be overestimated.

The cost of producing and delivering one ton of caliche, or crude niter, at Pueblo Viejio would be about $2.50, and the cost of shipment to the United States would be $3.80, delivered in New York, making a total of $6.30. This estimate is on the material in its crude state, and as it would take eleven tons of caliche to produce one ton of nitrate of soda, at a cost of $69.30, and the present market value would be only $50, it is evident that it would be necessary to separate the niter before shipping. I estimate the cost of separation, mining, and transportation to New York City at from $8.31 to $11 per ton. Then, besides the nitrate of sodium, we would have calcium phosphate (land plaster), an excellent fertilizer, 4,600 pounds, calcium phosphate 550 pounds, sodium bichloride (common salt), and vegetable matter 220 pounds. The above would be the residuum or by-products remaining after the refining process of the caliche has been gone through with. Or, to put it more plainly, we would have 7,370 pounds of fertilizing substances out of a possible 22,000 pounds, and of the residuum remaining, one-half would be calcium carbonate (ordinary lime).

In conclusion, I beg to state that I have every reason to believe that franchises or grants will be given by the Colombian government to any responsible individual or corporation that might guarantee to work the nitrate beds of that country.

Helping Street Cars up Hill.

A trolley line in Oil City, Penn., climbs a grade of nearly 14 per cent for almost 1,000 feet in one part of town. John B. Smithman, president of the company operating this line, has invented and patented a scheme for helping the cars up and down this slope. It consists of a counterpoise, lowered in a well, and connected by cable with the cars. A well is now being bored for this purpose, and is nearly finished. It is sunk from the top of the hill, and will go to a depth of 1,000 feet. The "balance," as it is called, will be a cylindrical iron bar, 4¾ inches in diameter and 40 feet long. A single car, Mr. Smithman estimates, weighs about seven tons, but on a 14 per cent grade it would require only one ton of vertical pull in the well to counterbalance it; and that is the weight so employed. A cable, running over a big, stout pulley, will connect the counterpoise with the car; and only one car at a time will be helped either up or down the hill; and, obviously, after an up trip the next one must be a down trip. The cable is attached to a "grip" on the car, and will run in a conduit. Mr. Smithman has invented a "differential" drum, which should render a hole half as deep as the grade is long available, but he will not use it in this first experiment. He has also thought of having a series of holes and weights where a grade is very long.—*N. Y. Tribune.*

Coating Aluminum.

At a recent meeting of the Berlin Physical Society Professor Neesen demonstrated a method of coating aluminum with other metals. This consists in dipping the aluminum in a solution of caustic potash or soda, or of hydrochloric acid, until bubbles of gas make their appearance on its surface, whereupon it is dipped into a solution of corrosive sublimate to amalgamate its surface. After a second dipping into caustic potash until bubbles of gas are evolved, the metal is placed in a solution of salt of the desired metal. A film of the latter is rapidly formed, and is so firmly adherent that, in the case of silver, gold, or copper, the plate can be rolled out or polished. When coating with gold or copper, it is well to first apply a layer of silver. When thus treated the aluminum may be soldered with ordinary zinc solder.

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FULTON'S TORPEDO.

The torpedo, that formidable modern maritime weapon of war, did not meet with great success at its advent, and it required more than sixty years, during which it was completely abandoned, for people to take it into their heads to see in it one of the most efficient means of attack, and especially of defense, against a naval force. Its inventor was not this person or that person, but simply Robert Fulton, who also invented the first submarine boats, and it is harsh to state that the sole glory that surrounds his memory comes to him from the application of steam to navigation—an application that he merely improved and in which he had been anticipated by the Marquis of Jouffroy in 1783.

Fulton wrote a very remarkable book, in which he describes his apparatus and makes judicious remarks upon the advantages that might be derived therefrom from a military, political and humanitarian point of view. But let us allow the eminent mechanician to speak for himself:

"In order to convince Mr. Pitt and Lord Melville that a ship can be destroyed by the explosion of a torpedo under its bottom, the Dorothea, a strongly constructed Danish brig of 200 tons burden, was, on the 14th of October, 1805, anchored in the roadstead of Walmer, near Deal, at a mile from Walmer Castle, which was then the residence of Mr. Pitt.

"There were put at my disposal and under my orders two longboats with a crew of eight men, commanded by Lieutenant Robinson. I prepared two empty torpedoes having a specific gravity of only two or three pounds more than that of salt water, and suspended them in such a way that they sunk to a depth of fifteen feet in the water. They were afterward made fast separately to the two ends of a slender rope 80 feet in length. The brig drew 12 feet of water.

"Each boat, with a torpedo in its stern, started from the shore at about a mile from the place where the brig lay and in front of the vessel. The rope that connected the two torpedoes was taut, and the boats were thus situated at 80 feet from each other. They then approached in such a way that one of them kept to the starboard and the other to the port side of the brig.

"As soon as the rope had passed beneath the buoy of the brig,* the torpedoes were thrown into the water and were soon carried along by the tide until the rope touched the cable of the brig's anchor, while the current carried the torpedoes under the ship.

"This experiment, thus repeated several times, taught the men in the boats how it was necessary to go to work, and proved to me indubitably that when the torpedoes are properly placed with respect to the current of the tide, they will go of themselves under the ship.

"I then filled one of the torpedoes with 180 pounds of powder and timed it for eighteen minutes."†

Fulton melancholily adds:

"Everything was ready, when it was announced that the experiment was postponed until the next day (the 15th), at five o'clock in the afternoon, because pressing business had called Mr. Pitt and Lord Melville to London.

"On the 15th Admiral Holloway, Baron Sidney Smith, Captains Owen and Kingston, Colonel Congreve and the majority of the officers of the fleet, under the command of Lord Keath, were present.

"At forty minutes past four, the longboats stood for the brig and the torpedoes were thrown into the water. The current of the tide carried them unimpeded under the keel of the brig which, at the expiration of eighteen minutes, appeared to rise about six feet through the effect of the explosion. It broke in two in the middle and the two parts sank. In the space of twenty seconds there was nothing more to be seen of the vessel except a few debris that were floating here and there."

After congratulating himself over the result obtained, Fulton adds:

"I consider it a fortunate circumstance for America, my country, that this experiment was made in England, and in the presence of more than a hundred respectable witnesses and brave officers of the royal navy, for, if Congress adopts the torpedo as a part of its means of defense, these high English personages know perfectly the effects and have preserved an impression of the results that it has been possible to reach."

Fulton, speaking in a note of an interview that he had with Count de Saint Vincent, gives us an account of a jocose remark that the latter made:

"In the first place, in the morning, the count was very communicative. I entered into all the details of the mechanism and use of the torpedoes with him and gave him an account of the experiment made with the Dorothea.

"After a few moments of reflection, the count said to me: 'Pitt is the biggest fool that ever existed to encourage a species of warfare useless to those who are the masters of the sea, and which, if it succeeds, will deprive them of this superiority.'"

After succeeding, at least partially, in alarming the British power, it only remained to Fulton to try to reassure his compatriots by showing them the efficiency of his new weapon. Consequently, in August, 1807, he rebegan his experiment in the port of New York. There were two fruitless experiments. One of them failed in consequence of a false maneuver and the other through the defective position of the fire locks in which the pr ming powder was placed. But, the third time, the experiment fully succeeded, and the vessel, which was this time again a 200 ton brig, was blown up under the same conditions that the Dorothea had been. In the following chapters, Fulton explains the methods of employing his torpedoes with advantage and with the least risk to the assailants. The first of these chapters treats of the torpedo at anchor, placed at the entrance to roadsteads and ports in such a way as to blow up ships coming into contact with it (Fig. 1).

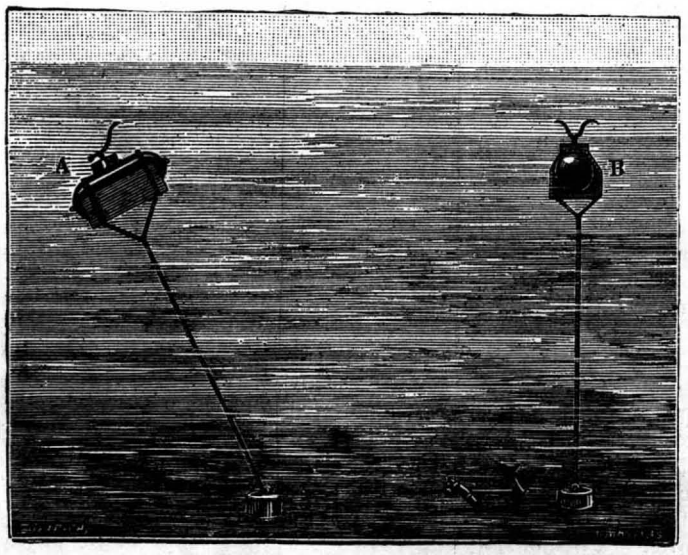

Fig. 1.—TORPEDO AT ANCHOR AND PLACED IN SUCH A WAY AS TO BLOW UP A SHIP COMING INTO CONTACT WITH IT.
A, inclination under influence of current. B, projection in direction of length.

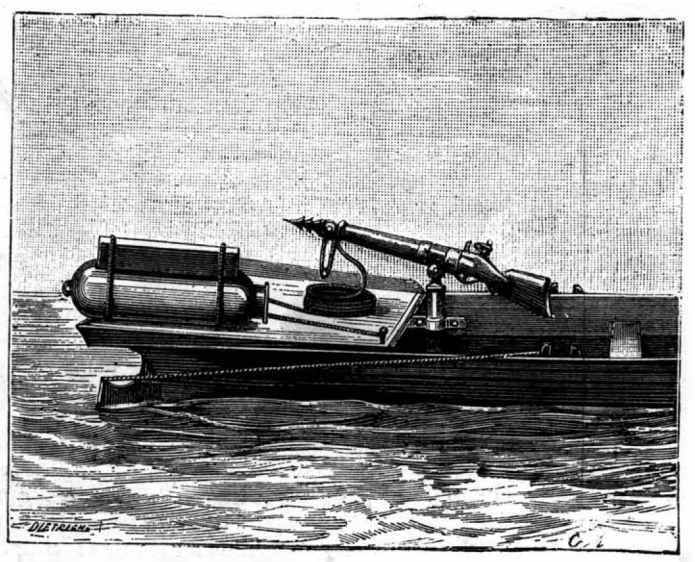

Fig. 2.—A TORPEDO BOAT PREPARED FOR AN ATTACK.

We shall not reproduce the description of this weapon, which is of no interest to us henceforth; but, in studying its working, we perceive that we are here in presence of the first blockade torpedoes, that is to say, one of the submarine defenses now rightly considered as the most formidable, or at least the most efficient and the most reliable, as physicians say of a remedy whose effect is certain.

There is nothing, up to the possibility of causing the torpedoes to return to the surface, that did not attract Fulton's attention and receive a satisfactory solution. The following, in fact, is what he says:

"In order to render it easy to remove the torpedoes from the channel, I have devised a very simple mechanism that will hold them under water at a given depth and for any number of days whatever. The movement of it can be regulated for a day, a week, a month, or a year, and, at the appointed time, the torpedoes will emerge. At the same instant each will automatically put its lever at rest, so that it will no longer be able to explode. And it will therefore be possible to handle them with safety. Having no time to have this improvement engraved, I am having a model of it made that I shall present to Congress, and which will facilitate the understanding of it."

Finally, Fulton finishes this

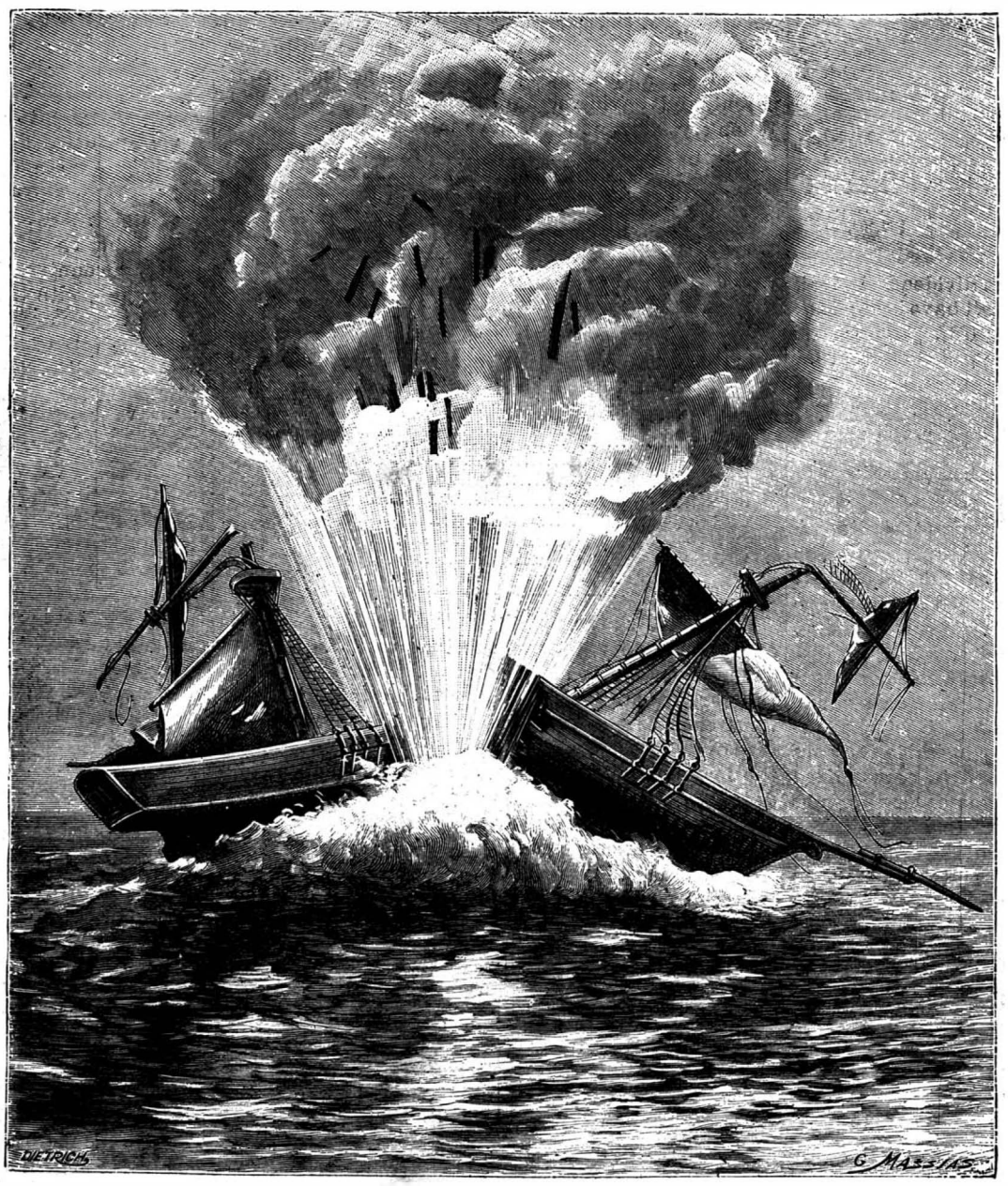

Fig. 3.—BLOWING UP OF THE BRIG DOROTHEA WITH A FULTON TORPEDO.

* In former times, a buoy was always stationed over the anchor, to the flukes of which it was attached by a rope.

† The torpedo was wound up by means of a clockwork movement.

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chapter with some very judicious observations, not a word of which is to be changed, even to-day.

"Upon considering this subject under all its relations. I remain persuaded that it would be impossible for any enemy whatever to enter a port in which torpedoes are used without exposing himself to a danger that all the courage possible could neither avoid nor surmount. Prudence and reason would make him abandon such an undertaking. It is even probable that, knowing us to be thus prepared, he would never attempt it, or that, if he did, the catastrophe of one vessel would suffice to guarantee us in the future against new hostilities."

In the following chapter Fulton describes a system of harpoon thrown by means of a small cannon or a blunderbuss, to which the torpedo is attached by a rope of variable length (Fig. 2).

It is unnecessary to say that this system is not utilizable to-day with our vessels all armored with iron; so we shall not dwell upon it. We cannot terminate this short retrospective review without citing the proposition that Fulton made to the government of his country and which figures in his book. We give it in order to show that this ingenious inventor was also a patriot and a man of noble heart:

"Moreover, in proposing this new plan of attack and defense, I do not pretend to abandon to others the care of executing it. If it is adopted in all its extent, with the proper number of men skilled in this maneuver, and if it is judged proper to put these men under my orders, and an enemy then enters our ports, I will satisfy my fellow citizens with the courage necessary to assure the success of the operation.

"But in proposing this, I wish to be well understood, in order that I may not be accused of aiming at a situation or command in a public station.

"My views are constantly directed toward an independence too dear to my feelings to allow me to desire to sacrifice them to ideas of any ambition whatever.

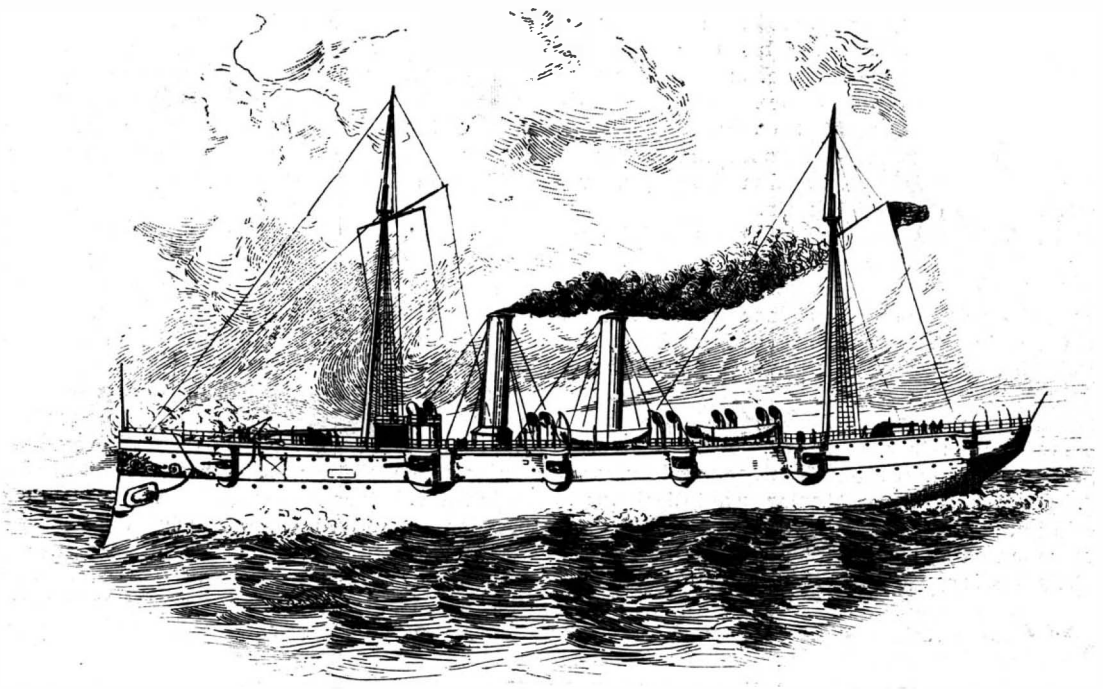
"I see here only a useful and, at the same time, honorable occupation, and it is to me a happiness to think that I can serve my country without any other motive than that of discharging the debt of a good citizen."

At our epoch, when torpedoes are adopted by all navies, it has appeared to us of interest to recall the labors of Fulton.—*La Nature.*

THE NEW UNITED STATES CRUISER MONTGOMERY.

The Montgomery, a sister ship of the Detroit, which we illustrated in our issue of September 2, 1893, succeeded in making 18·85 knots per hour over the entire course, thus demonstrating that she was the finest cruiser of her class. The Montgomery is known as a partially protected cruiser, a class of vessels which are now considered as very important adjuncts to the armored cruisers. After the tidal correction was made the speed was found to be 19 knots, so that the contractors (the Columbian Iron Works) will receive $200,000 in addition to the contract price, which was $612,500. The test was conducted with a steam pressure of 166 pounds, and the average number of revolutions was 180. The engines worked without any mishap, but the steering device was injured, or the speed would have been even greater.

The Montgomery is 257 feet long; 37 feet wide; draught, 14½ feet; displacement, 2,000 tons. Two vertical, three cylinder, triple expansion engines drive the two four-bladed propellers. The indicated horse power is 5,400. A protective deck varying from 0·43 to 0·3 inch thick is provided. The battery is composed of eight 5-inch guns and two 6-inch rapid-fire guns. There are also three torpedo-launching outfits and a secondary battery composed of six 6 pounders, two 1-pounders and two machine guns. For our illustration of the Montgomery we are indebted to *Marine and Railway.*

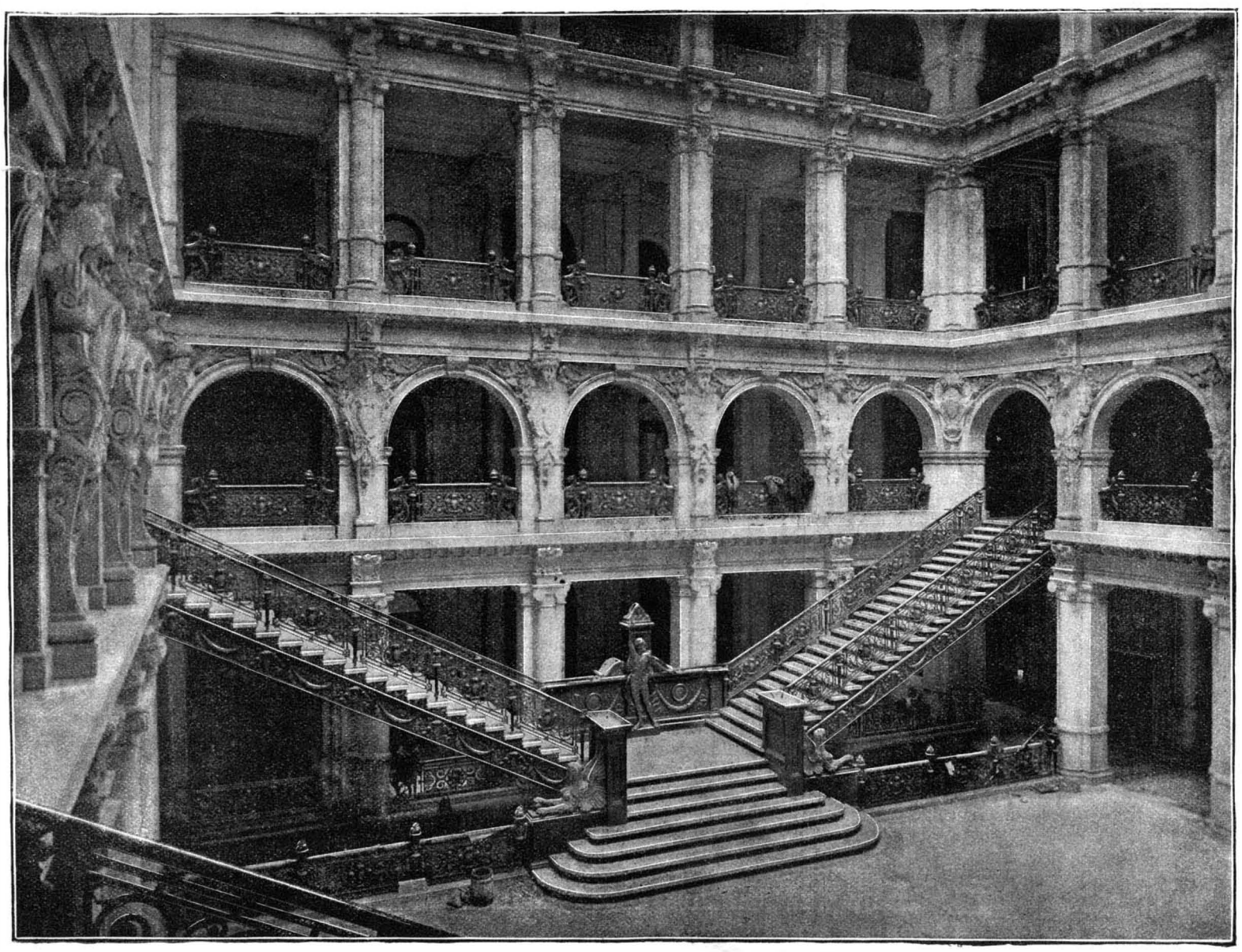


THE NEW UNITED STATES CRUISER MONTGOMERY.

THE CRIMINAL COURT BUILDING OF NEW YORK.

For many years the criminal courts of New York and the Grand Jury have been housed in a miserable fire-trap which should have been condemned long ago as unsanitary. In this rickety old building, ill-lighted, worse ventilated and reeking with sewer gas, other city offices were quartered, so that the space devoted to the criminal courts was totally inadequate, while the District Attorney has been obliged to occupy rented offices. At length the city fathers awoke from their lethargy, and on October 25, 1890, the corner stone was laid of a large and imposing edifice. The site is an historic one, being part of what was known in colonial times as "The Commons." The building occupies the block bounded by Center, Elm, White and Franklin Streets, and is connected with the city prison, usually called the "Tombs," by a bridge, which will probably be known as a "Bridge of Sighs." This bridge, which crosses Franklin Street, will enable accused persons to pass directly from the prison to the courts without being exposed to the gaze of the curious. The new building is 115 feet in height, and measures 188 by 190 feet, and in its plan allowance has been made for the widening of Elm Street.

The style adopted by the architects, Messrs. Thorn, Wilson & Schaarschmidt, is a modernized Renaissance, and the effect of the exterior is imposing. The edifice is constructed of light red pressed brick with trimmings of terra cotta and Belleville stone, and the



THE NEW CRIMINAL COURT BUILDING, NEW YORK.

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iron roof is covered with tiles. The basement is devoted to the Street Cleaning Department and the Bureau of Contagious Diseases. On the main floor is the Court of Oyer and Terminer, Court of Special Sessions and a police court. On the first mezzanine story are various offices connected with the court. On the second floor are the rooms for the Court of General Sessions, judges' rooms, etc. On the second mezzanine are the executive offices of the Street Cleaning Department, the Grand Jury room, Coroners' Court, District Attorney's offices, etc. The fourth story is devoted to the Board of Health and the Excise Board. The amount which the city has been paying for rented offices will now be saved. The building is all finished in natural wood and the lighting, heating and ventilation systems are as perfect as money can make them. Six elevators render the various offices easily accessible. Some of the principal court rooms are to be decorated at the expense of the Municipal Art Society by the best American mural painters.

It is customary for all important courts to be approached from an impressive vestibule or ante-room, to emphasize the dignity of the law, as in the *Salle de Pas-Perdus*, in the *Palais de Justice*, at Paris, and the arrangement is preserved here. From a large marble vestibule, the visitor enters the great rotunda, which we illustrate. This rotunda is sixty feet square, and is built of marble, elaborately sculptured in delicate figures and tracery. On each side grand stairways of iron and marble add to the imposing effect. The newel posts will be surmounted by elegant bronze electroliers. This huge rotunda is covered by an ornamental glass roof. The whole rotunda is treated with excellent taste, and it is one of the finest rooms in America, and compares favorably with the grand vestibule of the Paris Opera House, which it somewhat resembles, although, of course, the rotunda lacks much of the fine work which has been lavished on the Opera House. The entire building, with furniture, will have cost about $1,500,000, and the disposal of this money reflects credit alike upon the architect and contractors, and New York may now well be proud of this fine edifice.

Natural History Notes.

Do Scorpions Commit Suicide?—The question as to whether scorpions commit suicide or not by directing their sting against their own body when they are placed within a circle of fire or are tortured in some other manner by this element is one that has given rise to the most animated discussions. The opinion that they do is probably held by many persons at present. But Mr. Bourne's experiments on some Madras species have demonstrated: (1) that the poison has no effect upon the scorpion that receives it, and (2) that these animals are easily and quickly killed by a moderate heat (50° C.) Besides, when they are discommoded by too hot an atmosphere, or, according to Lankester, by the vapor of chloroform, scorpions have the habit of agitating their tail in the air and of darting their sting forward above the head as if to strike some invisible enemy. If, by means of a lens, the solar rays are concentrated upon a scorpion's back the animal is observed to immediately rase its tail and endeavor to remove the cause of excitation therewth. So the true explanation of some, at least, of the alleged cases of suicide among scorpions would appear to be this: The animals have really been killed by the heat to which they were exposed, and the observers have erroneously believed that the strokes of the tail were designed to put an end to the animal's sufferings.

My own experiments, says Mr. R. I. Pocock, are wholly in favor of this conclusion. Upon placing a speciment of *Euscorpius* in a corked test tube and holding the latter over a slow fire, I have found that as soon as the temperature of the air in the tube begins to rise the animal gives signs of great distress and beats the space for some seconds in brandishing its tail, and afterward falls into a state of insensibility. At this moment the glass of the tube was, nevertheless, but slightly warm to the hand. Taken from the tube and placed near an open window, the animal rapidly revived; but, upon a repetition of the experiment for a third time it died. It never tried to sting itself.

I have made also some experiments upon *Euscorpius* and *Parabuthus* in concentrating the solar rays upon them by means of lenses and in putting mustard upon the membrane between the plates of the back. In both genera, I have witnessed tentatives made to remove the cause of irritation by scratching the place affected with the point of the tail, but great precautions were always taken not to sting themselves.

It appears, however, that scorpions have been seen to sting themselves under similar circumstances. One observer mentions, even, in the case of a scorpion of the Indies, that blood issued from the wound made by the sting—a detail that strengthens the probability of the accuracy of the observation. But, *a priori*, it is not probable that the scorpion intended to kill itself. It is not impossible that a blow directed at hazard against an invisible enemy accidentally reached its author, or that, in the case of localized irritation, as happens with the use of a lens or the application of acids, whisky, or mustard, the scorpion, not succeeding in ridding itself of the annoyance by ordinary means, directs its sting upon the point affected with the intention, not of killing itself, but rather of destroying the cause of its pain.

Finally, it may be conceived that the cerebral faculties are deranged by the torture and the approach of death, and that the scorpion, no longer recognizing its own body by the sense of touch, stings it as he would sting any other object within its reach. A blow thus directed in one way or another may chance to pierce the brain or seriously lacerate the great dorsal blood vessel and thus cause death independently of the action of fire.

So then, although it is admitted that scorpions sometimes kill themselves, our verdict should be, it seems, accidental suicide, or suicide through lesion of the brain.

Inheritance of Acquired Characters.—Owing to their coiling, the shells of Ammonoidea and Nautiloidea have furnished biologists with much evidence bearing on theories of evolution, and now Professor A. Hyatt has discovered yet another point, which, he claims, proves that acquired characters have been inherited. Coiled Nautiloidea have, as every one admits, been gradually derived from straight forms, such as Orthoceras. The cross section of an Orthoceran, or even of a slightly curved Cyrtoceran, or loosely coiled form, is circular or elliptical, but the section of a close-coiled form, like Nautilus, shows an impression of that part which comes in contact with the preceding whorl, so that there is a re-entrant curve. In old age, however, when the shells again uncoil, this impressed zone disappears, and the section becomes circular again—a fact which seems to show that the feature is directly due to pressure, and is, therefore, an acquired character. As such it is not found in the early, uncoiled stages of those Nautiloidea that are close coiled in the adult; at least it is not so found in any of the Silurian or Devonian species. But at last, in the Carboniferous, Professor Hyatt has found a species that seems to prove his point; for, in *Coloceras globatum*, which is in many respects a highly specialized species, seven specimens examined have shown this impressed zone existing while the shell was still in the partly curved or cyrtoceran stage. The same early appearance of the impressed zone is likewise seen in numerous Jurassic, Cretaceous, and Tertiary species, including the living *Natilus pompilius*. This, then, seems due to the inheritance of a character in successively earlier stages of individual development, according to a well known law; while the character so inherited is believed to be an acquired one.

The Respiration of Plants.—Mr. Anton Amm gives in Pringsheim's *Jahrbucher* (vol xxv., p. 1) an account of some investigations on the intra-molecular respiration of plants. With regard to the relations between the amount of carbonic acid produced in this function and the degree of temperature to which the plants were exposed, it was found that the minimum temperature, as in the case of normal respiration, was below freezing point, since at 0° C. a significant amount of the gas was given off. As the temperature rose, intra-molecular respiration also gradually increased; but this increase was not proportional to the rise of temperature. In both wheat and lupine seedlings the optimum was reached at 40° C., which coincides with the optimum for the normal process. On the other hand, while there is, doubtless, a maximum temperature for the latter function, in the case of the wheat plant and *Lupinus luteus* somewhere about 45° C., there can, properly speaking, be no such point in the intra-molecular process, since, in absence of oxygen, seedlings cannot stand temperatures between 40° and 45° C. without prejudice to their vitality, and the rapid fall in the respiration curve when the optimum temperature is passed is due to the commencement of death.

The author finds the relation between the amounts of carbonic acid formed in the normal and intra-molecular processes to vary with the temperature.

The relation between the amounts of carbonic acid gas formed in the two processes varies in different stages of development of one and the same plant, the fraction increasing with increasing development. The present investigations have also supplied fresh confirmation of the fact that, by the withdrawal of oxygen, production of carbonic acid at once sinks in amount, but remains constant for a long time at the lower level, and immediately rises again to the original amount when oxygen is again supplied.

Finally, the results show that the different organs of a plant, *e. g.*, flowers and leaves, give an almost identical relation between the normal and intra-molecular respiration, while the organs of different species show quite a different relation.

Effect of Temperature on the Coloring of Lepidoptera.—By careful and long continued temperature experiments in pedigree moth breeding, Mr. Merrifield has demonstrated the possibility of producing artificially from a single brood of a moth, subject to seasonal dimorphism, four distinct "temperature" varieties, viz.: summer markings with summer coloring, summer markings with an approach to spring coloring, spring markings with summer coloring, and spring markings with spring coloring. The conclusions reached as a result of this series of experiments are that the coloring and markings of the moth are affected by the temperature to which the pupa is exposed, the marking being chiefly produced by long continued exposure; that the coloring is effected chiefly during the stage before the coloring of the perfect insect begins to show that a low temperature during this stage causes darkening, a high temperature producing the opposite effect, a difference between 80° and 57° being sufficient to produce the extreme variation in darkness caused by temperature; a further lowering of temperature having no further effect; that nearly the full effect in coloring may be produced by a range of temperature of from 76° or 80° to 65° in *autmnaria*, and from 73° to 60° in *illustraria*; that dryness or moisture during the entire pupal period has no appreciable effect on the coloring of the adult.

A general conclusion which the author ventures to suggest (provided we accept the theory of Professor Weismann, that existing forms of North American and European Lepidoptera have come down from a glacial period) is that "icing" the pupa causes the insect to revert to its earlier form, and that experiments of the nature here recorded might be of materal assistance in tracing the evolution of the markings on the wings of the most highly developed forms.

Mr. Merrifield states that it is possible to cause either the summer or winter form to take on the coloring of the other, and produce from moths from the summer pupa specimens that resemble those from the winter pupa, but not *vice versa*.

Mars.

The following questions and answers are from a recent number of *Popular Astronomy:*

Why do astronomers think that the white spots about the poles of the planet Mars are snow or ice?

G. B. D.

Answer.—In connection with this question it was noted by the querist that the telescope shows a change in size of these white patches during the seasons of winter and summer on the planet Mars. This is the main reason why it is thought that the patches consist of ice and snow. It might be added that some good observers have seen indications on the surface of the planet that might be explained by supposing that a fall of snow had covered a considerable area. No astronomer would feel himself justified from his observations or what he knows of the surface of the planet, in assigning snow or ice as the cause of these white spots. Other plausible reasons could be assigned. Some observers have intimated that clouds in the planet's atmosphere might produce the appearance observed. This explanation does not seem as satisfactory as the former one.

From appearance in observation the atmosphere on Mars contains less clouds than that of the earth. If capacity for heat depends on the vapor in the atmosphere, how is it that the temperature of the planet's surface seems so high compared to that of the earth, notwithstanding its greater distance from the sun?

G. B. D.

Answer.—We are not aware that observers are agreed, or generally think, that clouds are less in the atmosphere of Mars than in our own. That would be an impossible thing to determine by observation at the distance of Mars, if we remember that our clouds do not run probably much above two miles in height on the average, except, as it might be inferred, that certain changes in color of surface markings are due to the presence of clouds. It is probable that the density of the atmosphere of Mars is less than that of the earth; the spectroscope also indicates that there is watery vapor in the atmosphere of Mars. From all that is known, or may be fairly inferred by analogy, we would say the temperature of Mars ought to be much lower than that of earth. But if appearances are not misleading, water on its surface does not freeze except in the region of the poles. If earth were viewed from Mars, it is plain that the polar white caps would be much larger than those of Mars are.

Astronomers do not give any reason for this unexpected difference in surface temperature on the planets. There is no known explanation.

A New Test Paper.

A very sensitive test paper may be easily prepared from mallow flowers (*alva*). The violet petals only are used, rejecting the green part of the flower. Fifty petals being infused in 100 c. c. of cold water, a faint violet solution is obtained. This liquid becomes

Ponceau red	on addition of	mineral acid.
Wine red	"	"	organic acid.
Violet red	"	"	acid salts.
Greenish blue	"	"	alkaline salts.
Green	"	"	alkaline carbonates.
Green (yellowish)	"	"	soaps.
Yellow	"	"	potash, soda or ammonia.

The alkalinity of a soap may be nicely gauged by this test.

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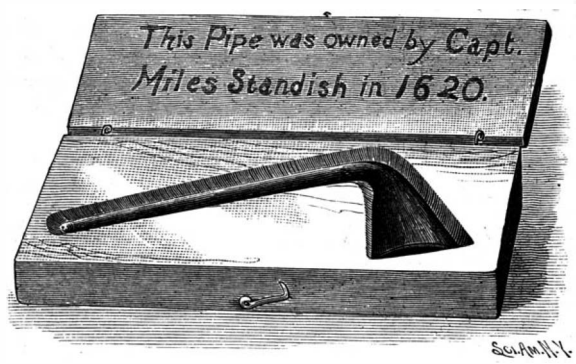
THE COLUMBIAN EXPOSITION—COLONIAL RELICS.

There were many curious historical relics in the Government building, but a number of these could not be thoroughly enjoyed without an understanding of the story connected with them. The famous torch of Israel Putnam attracted many visitors. Anything connected with General Putnam, who is one of the most picturesque figures in American history, must always be of interest to Americans. The torch was made of birch bark, rolled into the form of a cylinder, about one and one-half inches in diameter. The story connected with the torch is as follows: In the year



MILES STANDISH'S PIPE.

1739 Putnam removed from Salem to Pomfret, an inland Connecticut town, forty miles east of Hartford. Our hero applied himself to farming in the new country with the same vigor he afterward displayed in his warlike exploits. One night seventy-five sheep and goats were destroyed by wolves, or rather one she wolf, which had infested the vicinity for years. At last this wolf became such an intolerable nuisance that Putnam and five neighbors agreed to pursue the animal until caught. At last they tracked the wolf to her den. The people soon collected with dogs, guns, straw, fire and sulphur, and every attempt was made to force her from the small cave or den. Neither smoking straw nor burning sulphur had any effect on the animal. Mr. Putnam proposed to his negro man to enter, but the negro declined. Angered at this, Putnam stripped off several pieces of birch bark which had become rather dry and rolled them up to form a torch; lighting this, he proceeded through the long and tortuous passages. After groping around for some time he came in sight of the wolf, who growled. The friends of Putnam had fastened a rope to his leg, so that he could be drawn out, if he should be in danger. When the wolf growled they pulled the rope, and he was dragged out with many bruises. He loaded a gun with buckshot and descended again. This time the wolf was shot, and he was pulled out again, to the detriment of his clothes and skin. After being refreshed (history sayeth not how), he descended again, and, perceiving that the wolf was really dead, he kicked the rope, and in a moment Putnam and the wolf appeared, to the exultation of the assembled people. The torch was ever after preserved as a memento of the occasion.

Another curious and historical relic of an earlier date which was also exhibited in the Government building was the pipe of Miles Standish. This pipe is carefully preserved in a wooden case. Miles Standish was born in Lancashire, England, in 1584, and died in Duxbury, Mass., in 1656. He was chosen captain of the Pilgrims, although he was not a member of their church. The temper of Miles Standish was none of the sweetest, but he made himself very useful to the colonists by his courage and determination. As agent for the colony he visited England in 1625, and for the remainder of his life he occupied the position of magistrate. The colonial relics in some of the State buildings were specially interesting and valuable.

Manganese Steel.

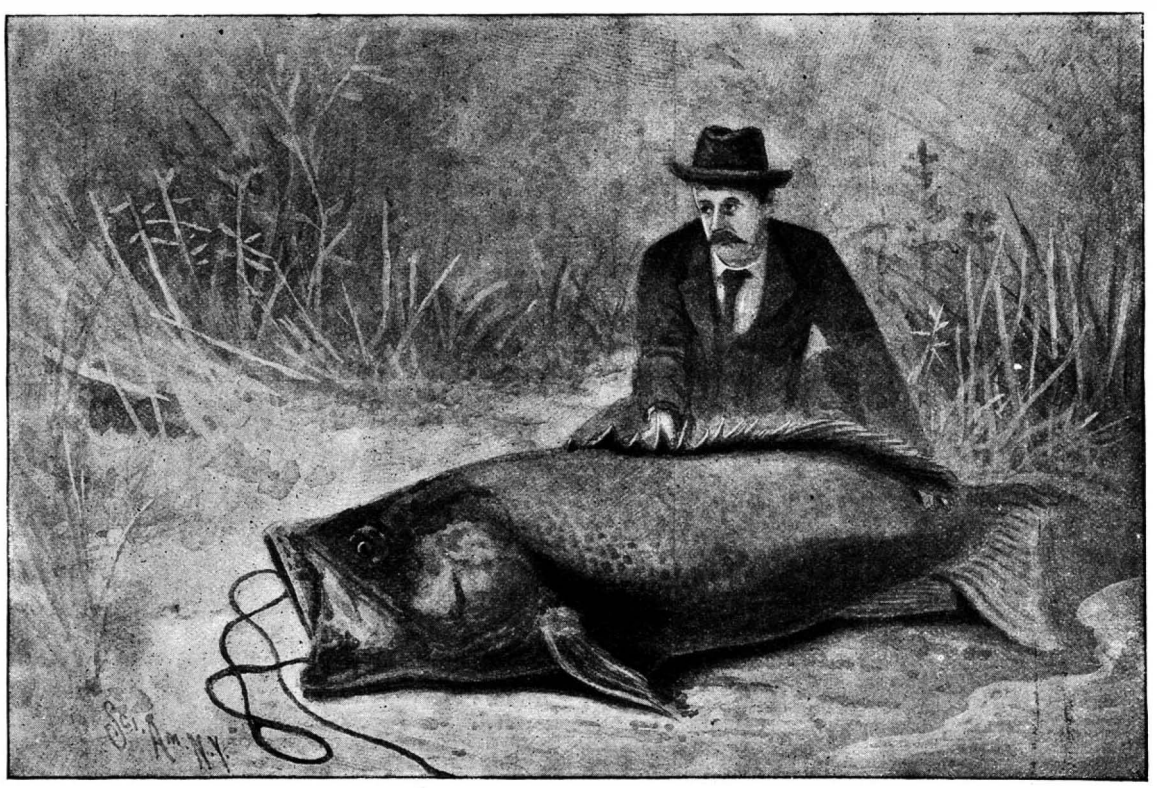
Manganese steel, containing about 43 per cent of manganese and 1 per cent of carbon. H. M. Howe says that the most important single use for manganese steel is for the pins which hold the links of dredgers of the elevator or bucket type. As they resist the abrasion caused by the sand and grit between them and the links in which they turn, they last from six to eight times as long as ordinary carbon steel pins. Manganese steel plowshares wear six or seven times longer than chilled cast iron shares. The side plates of the Blake ore crusher made of hard carbon steel are worn out in two months, whereas when made of manganese steel only one-fourth of an inch was worn away in ten and a half months. In respect to railway wheels, it is believed that chilled cast iron wheels run about one-third the mileage of manganese steel wheels before the first turning; and, again, the average mileage of the latter is 51 per cent greater than that of the composite or steel-tired wheel.

Drainage of the Valley of Mexico.

According to the British consul at Mexico, the great work of draining the valley of Mexico, comprising over thirty miles of canal and six miles of tunnel, is within measurable distance of completion. On May 16, 1893, 63·19 per cent in the grand canal had been excavated. When finished this canal will be 29⅜ miles long. Of the tunnel 70·63 per cent had been completed, and of the remainder 983 lineal yards of heading—perhaps the most troublesome part of the work—had been done. The total cost of the canal and tunnel, from the time when the committee of management took charge of the work in 1886 to last May, has been over $7,000,000. Though a good deal of money had been expended, mostly in preliminary work and surveying, very little of the canal and tunnel had been constructed, so that the foregoing measurements may be fairly taken to represent the work done for the given amounts. The cost of the work has been heavier than was expected. When the contract for constructing the canal was let to Messrs. Pearson & Son in 1889, the cost was estimated at about $5,000,000. A sum of $3,800,000 has been spent, and about $2,300,000 more will be required to complete it. Owing to the unexpected amount of water met with in working the tunnel, the cost per lineal yard has been much in excess of the contract price. As the water is completely dominated along the whole line of the tunnel, and all the ventilating shafts are finished and equipped, it is probable that the estimate for finishing the work, which is based on the average cost per yard, will be found to be within the mark.

THE JEWFISH.

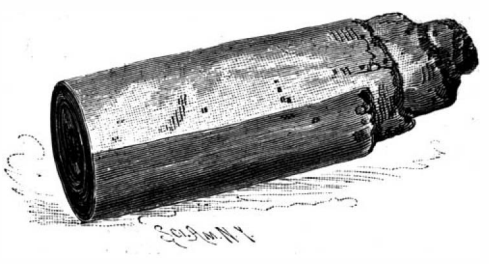
The jewfish abounds on both the coasts of Florida and in tropical seas. The jewfish is frequently found in the deep holes and channels in the salt water inlets. The specimen we illustrate weighed about three hundred and fifty pounds, and was captured near Tampa Bay, Florida, by Mr. H. Bomford. The huge fish after being harpooned twice and wounded in three places on the head with a hatchet, lived two days, and was finally butchered and sold. It required the services of three men to land the fish, and they worked an hour and a half to accomplish it. Specimens of jewfish have been captured which weighed over five hundred pounds. It is said that even the largest jewfishes are good eating, the Cubans considering them a great delicacy. Some of the stories related of the strength of the jewfish are very remarkable, and it is said that boats have been towed out to sea by this fish. The jewfish will often break hooks and lines which are strong enough to capture a good sized shark. Mullet bait is usually used in catching the jewfish. This fish frequently floats on the surface of the water, apparently asleep, and is sometimes shot instead of being harpooned. The jewfish is probably the largest food fish known.



THE JEWFISH.

Removing Evergreen Trees.

There are many localities, says the *Country Gentleman*, where a natural growth of evergreen trees in the borders of woods and the margins of swamps affords opportunities for procuring pines and cedars. Rows of suitable size and only a few feet high might be transplanted for an occasional ornament of the home of the farmer, or for shielding the cattle yards in winter. The difficulty is that most farmers are not aware that they can be removed with safety. They have witnessed some attempts, and the result, so far as they have observed, is dead trees. They suppose



PUTNAM'S TORCH.

the work to be exceedingly difficult or expensive. There is no doubt that much needless labor is expended in the unnecessary attempts which have been made, and what has been published on the subject has not greatly helped the matter. An excellent work on forest trees, and one of the best that has been published in the country, gives the following directions for transplanting: "In planting trees that are not small, the roots should be extended on all sides to their full length. Some advise removing large evergreens with a ball of frozen earth around the roots, and the roots are almost uniformly cut short." The writer appears not to have been aware that the length of the roots of nearly all trees is at least as great as their height, and if those which he describes as not small are only 12 feet high, then the roots extending 12 feet on each side "to their full length" would occupy a circle 24 feet in diameter—which would obviously be quite impracticable. We have found the practice of cutting a ball of earth, or rather a flat mass, and conveying it with the tree, even if the roots are cut much shorter than would seem necessary—we have found this practice much the safest and surest in removing trees from their native localities. If the mass of earth is large enough to hold the tree upright when set on the surface of the ground, it is safe to insure the life of the tree. Not one in twenty properly treated in this way ever perishes in removal. These remarks do not apply to nursery trees. The work may be done any time of year.

A single instance will serve to illustrate the matter. Two neighbors, who lived 12 miles from a fine locality of handsome white pines, went to procure a wagon load each for ornamenting their grounds. One of them took up six or eight trees with a good mass of earth on the roots. The other, despising such care, tore out his 50 trees with denuded roots. These all died, the others all lived.

It is not necessary to do the work in winter with "frozen balls." For small trees from 3 or 4 to 7 or 8 feet high, the spade may do all the work with a tough or matted soil.

Enriching of Skim Milk.

This invention relates to a preparation of oil ("artificial cream") which may be readily and permanently incorporated with any liquid, and is intended to be employed chiefly for enriching skim milk, and render it available as cattle food. The preparation is made by simply mechanically emulsifying any suitable oil with a solution of glue or gelatin, and finally diluting with water to any desired consistency. To 1 kilo of oil about 50 grammes of glue may be used. "Artificial cream" keeps well, and may be mixed with any liquid by simply stirring it in. It separates again only very slowly, and, in so doing, rises to the surface exactly like natural cream, and it suffices to stir the liquid to obtain as perfect a mixture as before.—*G. Dierking.*

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RECENTLY PATENTED INVENTIONS.

Engineering.

DITCHING MACHINE. — George M. Pilcher, Logansport, Ind. This machine has a swinging boom, a driving rod operated by cable mechanism, and movable converging shovels working in guides at the lower end of the driving rod, to force the shovels downward and together, the machine having an attachment adapted to break up frozen ground and rock. The machine is adapted, as it is moved along, to rapidly and economically excavate a smooth wall ditch, the carriage being provided with a boiler and engine of any suitable type, and the shovels being raised and lowered by suitable hoisting mechanism.

Railway Appliances.

HAND COUPLING DEVICE.— William E. Burriss, Kansas City, Mo. The extensive use of the old style link and pin coupling, notwithstanding the many improvements made, has led the inventor to devise this device, which consists of a spring-controlled extension rod, to be attached to the arm, and which when not in use will be concealed beneath the coat sleeve, but which may be readily elongated and held in extended position to guide a link when cars are being coupled, obviating the necessity of trainmen going between the cars for this purpose. The device is of simple construction and inexpensive, and has received the indorsement of prominent railway officials.

SWITCH OPERATING DEVICE —Handley P. Cogswell, Brooklyn, N. Y. The switch rail is, according to this invention, connected with a switch lever located about centrally of the track, and adapted to be operated by shoes connected with and extending beneath the car. The improvement is especially applicable to street cars, enabling a switch to be readily opened or closed from a moving car.

RAILROAD TIE.—John C. Lee, Beaver, Texas. This is a metallic tie having on its ends elevated track supports, each having dovetailed recesses to which are fitted jaws, the jaws as well as the support being bound by a bolt upon the foot and web of the rail. The rail is thus forced into firm contact with the tie, and the latter is prevented from tilting on its foundation. The bottom of the tie is transversely ribbed under the rail seat to prevent lateral movement.

Electrical.

ARC LAMP.—Manuel R. Gutierrez and Milton T. Thompson, Jalapa, Mexico. The carbons of this lamp are arranged on pivotal supports, so that they are held at varying angles while being consumed, the arrangement being such that there will be nothing to intercept the rays of light from falling directly below the lamp, no portion of the carbon supports being below the arc formed. The lamp occupies only a small space, and is light and easy to handle.

AUTOMATIC CIRCUIT CLOSER.—Henry Lewers, Carson City, Nev. A simple and effective device for fire alarm circuits is provided by this invention. A tube of insulating material permanently closed at one end contains a spring to which is fitted a follower, while a stopper of insulating material fitted to the open end of the tube carries two electrical contact pieces, there being a circuit-closing pin in the central bore of the stopper, and a cap with fusible or explosive material for holding the contact plug away from the contact pieces. The device is actuated to give an alarm when heated above a certain temperature.

Mechanical.

LET-OFF MECHANISM FOR LOOMS.—Jeremiah C. Bill, Willimantic, Conn. Combined with a pivoted counterbalanced arm over which the warp threads pass is a pivoted sliding cam connected with and rocked on its axis from the arm, a friction wheel loose on the axis of the cam being moved laterally by the cam and geared to the warp beam, while a power-driven friction wheel also on the axis is engaged by the other friction wheel when the cam is rocked from the counterbalanced arm. The invention is an improvement on a former patented invention of the same inventor, the device being of simple construction, with but few parts and not liable to get out of order, although very sensitive and automatic in operation.

COMPENSATED PENDULUM MOTOR.—John M. Cayce, Nashville, Tenn. According to this improvement two aligned shafts are arranged coincidently with the fulcrum of a tilting frame, and provided one with a weighted pendulum and the other with a weighted arm projecting in an opposite direction, there being pulleys mounted on the shafts and on a superposed rock shaft, with belts arranged to cause a given motion to the rock shaft to impart a reversed motion to the pendulum and counterweight.

MOTOR.—John C. Lueneburg, Lakefield, Minn. This is an improvement on a formerly patented invention of the same inventor, and consists of a main driving shaft rotated by gear wheels moved by a sprocket chain, a reciprocating crosshead carrying spring-pressed pawls adapted to engage the strands of the chain. The motor is especially designed for readily and powerfully propelling vessels, vehicles, etc., by the strength of the occupant.

WAVE AND CURRENT POWER.—Singleton Husted and Irvin P. Doolittle, Los Angeles, Cal. An intake box arranged near the shore is adapted to receive water at the highest point of the waves, and a raceway leading from this box contains a water motor, the raceway being arranged in the path of the undertow, or outgoing current, to make use of its suction or exhaust. If desired, a number of intake boxes may be connected with each other, to permit a very large amount of water to pass down the raceway at the receding of the waves.

WRENCH.—William A. Papoun, Baker City, Oregon. In this tool a toothed shank carries the fixed jaw, a movable jaw with a handle part sliding on the shank. In the movable jaw is a sliding finger piece engaging bevels on the jaw, while a toothed plate engages the shank, a button projecting from the plate through a longitudinal slot of the finger piece. The construction is strong and simple, and the jaw may be very conveniently locked and unlocked for adjustment to various sized objects.

SAW CLAMP.—Fernando W. Seaver, Bennington, Ind. This is a strong and simple device for holding saws to be dressed, and consists of an upright frame whose upper ends are secured to a long jaw, and on this frame is fulcrumed a swinging frame with side levers carrying a jaw at their upper end, the jaws having flat surfaces adapted to fit snugly against a saw. Both hands may be used to place the saw, which is fixed by a single movement of the foot by a treadle-operated cam mechanism.

Agricultural.

CANE PLANTER. — Eligio Olivera y Martinez, Havana, Cuba. This is a machine of strong and simple construction, which cuts the cane in suitable lengths for planting as fast as it can be fed to the cutters, and then deposits the cane in the furrows prepared to receive it while the machine is advancing. The machine is also provided with markers, to be carried in the direction of either side, and has a covering device for closing the furrows after the cane has been deposited, the cutters and planting cylinders being automatically operated as the machine is drawn over the ground.

PEA SHELLING MACHINE.—David A. Gaither, Williston, Tenn. The peas as gathered from the vines and poured into the hopper of this machine are fed to thrashing or hulling cylinders so grouped, and sustaining such relation to each other, that the pods will be broken, the peas thrashed out, and the pods separated and delivered in one direction while the peas go into an off-take chute, where they receive an air blast to free them from all foreign particles.

COTTON CULTIVATOR.—Henry Nehrmeyer, Reinhardt, Texas. This machine has at its front end opener or weeding plows to cut the plants to form the rows, while a series of finger plow gangs is arranged to travel between the paths of the weeding plows over the rows or intended stand, the beams of the latter plows having their front ends pivotally connected to the main frame, and their rear ends held for independent vertical movement. The machine is particularly adapted to thin out irregular growths and bring them to a proper stand in a quick and economical manner, five or more stands being obtained at one operation of the machine.

Miscellaneous.

SHINGLE BUNCH AND BINDER.—William J. Munro, Joseph Hart and David Batey, Sedro, Wash. According to this invention shingles are bunched to occupy the least possible space for kiln drying or transportation, the shingles being arranged in substantially the usual way, but the invention providing a novel form of binder occupying scarcely any space, easily applied, and having the necessary strength, the bunching being thus effected more economically than by the ordinary method.

SASH FASTENER.—Wellman E. Cline, Doylestown, Ohio. This is a lock and stop, consisting of a casing in which a locking wheel is eccentrically pivoted, a spring-controlled operating lever being eccentrically connected with wheel by a link. The device is inexpensive and may be applied to a window frame for engagement with the sash, or attached to the sash for engagement with the frame, in either case permitting the sash to be readily raised or lowered from a locked position, upon releasing the lock, the sash being otherwise firmly held.

TRANSOM LIFTER.—George M. Garland, Des Plaines, Ill. This invention provides a simple mechanism by which one or a series of ventilators may be conveniently worked. A bell crank lever pivoted at its angle to the transom frame is connected by one of its arms through a link with the free end of the transom, the other arm being connected with an operating cable. Pivoted rod connections guide the movement of the transom and bell crank lever, and the device is quite inexpensive.

COAL SCREEN, ETC.—George W. Cross, Pittston, Pa. The screening surface of this screen is constructed of segmental plates in which are openings corresponding to the meshes of wire screens. The openings of the screen are, however, separated by walls of a peculiar undulating form, presenting alternate convex and concave surfaces, to cause the coal or other lumpy material to practically pause and turn at the meshes, instead of sliding over them, thereby facilitating the sizing of coal.

VEHICLE SEAT.—Charles M. Kellogg, Chetek, Wis. This seat has a lazy back section which has a hinged connection with the back proper of the seat, and is connected with spring-cushioned slides, so that when one presses against the lazy back section it will fall back somewhat against the tension of the spring. The seat is designed to very comfortable, enabling one to assume any desired position in traveling.

ICE CREAM FREEZER. — Thomas J. Harton, Waco, Texas. This freezer is essentially a revoluble cylinder divided into a series of compartments, the central one being adapted to receive the cream moulds or receptacles, an end compartment receiving milk or lemonade, etc., and intermediate compartments holding ice or other freezing medium, the cylinder being supported in a suitable casing and revolved by a crank.

ENVELOPE FASTENER.—Paul E. Gonon, New York City. A separate straight elastic arm attached to the envelop flap is, according to this invention, adapted to be bent or crimped near its ends to engage apertures in the back of the envelope, and when released to enter the envelope by its elasticity, whereby the flap is locked to the back of the envelope without using an adhesive substance.

VENDING MACHINE.—Edward D. Valentine, New York City. This machine has an upright coin passage in which a flat spring is arranged to be pressed upon by a descending coin, a swinging frame containing the goods to be vended, while a package discharging mechanism arrested by the spring is released by the pressure of the coin. The machine may be adjusted to deliver various small articles in separate packages.

TRAP. — Hubbard S. Goff and Alvin B. Judkins, Los Angeles, Cal. This invention covers an improvement in animal traps, which may also be used to catch fish. It has oppositely arranged spring-pressed jaws pivoted together at their inner ends, one of them having an opening to facilitate baiting, a locking mechanism holding the jaws open, a trigger releasing them, and a hook closing the bait opening.

ANCHOR FOR VESSELS. — Ruben Zertuche, Saltillo, Mexico. This anchor is more especially designed for flat-bottomed vessels, the anchor consisting of a flat rectangular plate of sheet metal, designed to be supported by the anchor chain in a nearly horizontal position in the water below the vessel, and not to take hold on the bottom, the column of water bearing upon the flat plate serving to hold the vessel steady, keep its head to the wind, and prevent drifting to leeward.

VESSEL CONSTRUCTION.—The same inventor has obtained another patent for a novel construction of the hull of a vessel, according to which a flat plate extends beyond both sides and flush with the stem and stern, there being a buoyant compartment between the plate and hull, and braces removably connected with the hull and plate. The vessel is designed to be of very light draught and have great stability.

TENT.—George Tolmie, Carbon, Wyoming. A door-closing strip extends across the threshold of the door opening, according to this invention, while a flooring strip is connected with the threshold portion of the closing strip, there being inside cords adapted to fold the closing strip upward over the opening, or open it out, from the inside.

PNEUMATIC TIRE.—William R. Barrett, Passaic, N.J. This tire has an inner inflatable tube with the usual valve, an outer split cover with interlocking coils at the meeting edges, washers encircling the valve of the inner tube, while a flexible fastening rod has one end held to one washer and the other end screw-threaded to engage the other washer. This tire may be readily fastened to a wheel, and its cover readily opened to give access to the inner tube, which may be easily taken out and a new one substituted.

STAND ATTACHMENT FOR BICYCLES.—Elihu S. Bishop. Milton-on-the-Hudson, N. Y. A bracket which may be readily applied to the bicycle frame has a pivotally connected spring-controlled leg, which also carries a brake shoe and a locking device. When not in use the attachment may be readily folded up out of the way.

BADGE. — James R. Lee, Baltimore, Md. This badge consists of a ribbon on the face of which is secured a separate emblem-bearing fabric by means of a novel form of foundation, which maintains the fabric in convex form for the better display of the emblem.

MARKING DEVICE.—Edward W. Dodge, Augusta, Ga. This device comprises an open frame within which is stretched an ink ribbon or fabric, with both surfaces exposed, the device forming a transfer slate, to be written upon with a stylus when the characters traced are transferred to the articles beneath.

DESIGN FOR A SPOON. — Austin F. Jackson, Taunton, Mass. In this design the handle is waved or serpentine and has beadlike representations forming the border of a central panel, above which is the simulation of a shield.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

OBJECTS OF INTEREST TO ENGINEERS AND OTHERS IN AND ABOUT PHILADELPHIA. Philadelphia. 1893. Pp. 109.

Philadelphia, pre-eminently a manufacturing city, is treated in this work as an engineers' inspection field. The different factories and engineering objects situated in it and about it are here indexed and their addresses and striking features given, with full references to the accompanying map. It is issued by the Engineers' Club, and is in all ways an admirable publication.

SLIDE VALVE DIAGRAMS. A French method for constructing slide valve diagrams. By Lloyd Bankson. New York: D. Van Nostrand Company. 1892. Pp. 29. Price 50 cents.

Eight folding plates are required to elucidate the short text of this book. It gives a graphic method of solving slide valve problems and from its conciseness and simplicty will, we are sure, be found of use to the designer of engines.

A STANDARD DICTIONARY OF THE ENGLISH LANGUAGE. Prepared by more than two hundred specialists and other scholars, under the supervision of Isaac K. Funk, editor in chief; Francis A. March, consulting editor; Daniel S. Gregory, managing editor. Associate editors, Arthur E. Bostwick, John Denison Champlin, Rossiter Johnson. Volume I. New York, London and Toronto: Funk & Wagnalls Company. 1893. Pp. xx, 1060.

We have received the first volume of Funk & Wagnalls dictionary. When we consider that the work is designed to surpass, in its number of words, all preceding dictionaries of the English langnage, that it takes cognizance of the most recent philological developments in the way of spelling, pronunciation, and derivation, that it is profusely illustrated with not only wood cuts but also with very elegant colored plates, the utter inadequacy of a review within the limits of our space will be apparent. Its list of editors embraces many names in all possible connections. Simplicity, accuracy, and comprehensiveness are alleged to be three features impressed upon the corps of editors. The distinctive features indicate a thorough systemization of the work. Thus the etymology is placed after the definition. In the definition of words the most common meaning is given first, the order of usage replacing the historical order hitherto favored. For giving the pronunciation of words what is known as the scientific alphabet is used. This alphabet has been prepared and recommended by the American Philological Association and adopted by the American Spelling Reform Association. This is an immense advance over the arbitrary system used in so many other works of this character. Quotations are referred to book, page, and edition, as well as to the author's name, so that they are susceptible of verification in the library. New quotations have been sought for, the works of 3,000 authors having been read by nearly 1,000 readers. Disputed pronunciations and spellings, various pronunciations of words and nearly 5,000 pictorial illustrations have all received the fullest consideration and the most advanced treatment. It is claimed that it will contain 280,000 words and terms—55,000 more than in any other dictionary. The prospectus develops this and other salient features and indicates very advanced views on the part of the editors as to the proper methods of constructing such a work.

The Art Wall Papers of H. Bartholomae & Co., of West Twenty-third Street, New York, and a branch of the National Wall Paper Company, afford the subject of a beautiful set of plates recently published by the firm in folio form, in heavy board covers. They include views of the hall, parlor, library, dining hall, and boudoir, elegantly and artistically furnished and decorated in new and rich styles designed by the artist of the firm, Mr. Paul Groeber, of Rutherford, N. J., who also makes the drawings for this folio. The artist received a special medal at the World's Columbian Exposition for the architectural design and decorations of the pavilion of the National Wall Paper Company's exhibit.

From Thomas J. Dowling, Commissioner, having charge of the Bureau of Statistics of Labor of New York State, we have received four volumes published by the Bureau, and principally compiled under the direction of his predecessor, Charles F. Peck. They treat of "Strikes and Boycotts," "Rates of Wages," and "Economic Development for Ten Years."

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY, 1894.—(No. 100.)

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1. Elegant plate in colors showing a suburban dwelling at Plainfield, N. J., erected at a cost of $4,800 complete. Floor plans and perspective elevation. A tasteful design. Messrs. Rossiter & Wright, architects, New York.
2. Plate in colors showing an elegant residence at Pelham Manor, N. Y. Perspective view and floor plans. Estimated cost $7,000 complete. An excellent design.
3. The Jamaica Club House, recently erected at Jamaica, N. Y. Perspective views and floor plans, also an interior view. Cost $9,000 complete. Messrs. Haus & Oborne, architects, Brooklyn, N. Y.
4. A beautiful residence at Portchester, N. Y., recently erected for A. V. Whiteman, Esq. Perspective and floor plans. Mr. Frank W. Beall, architect, New York.
5. Engravings and floor plans of a suburban residence erected at Ashbourne, Pa., at a cost of $4,800 complete. An attractive design. Harrison Allbright, Esq., architect, Philadelphia, Pa.
6. A suburban dwelling recently erected at Edgewater, Ill., at a cost of $10,216. Floor plans and perspective elevation. Mr. F. B. Townsend, architect, Chicago.
7. A colonial cottage at Buena Park, Ill., recently completed for Guy Magee, Esq. Floor plans and perspective elevation. An artistic design.
8. A modern half-timbered cottage at Wyncote, Pa., erected at a cost of $4,250 complete. Floor plans and perspective elevation. Mr. A. S. Wade, Philadelphia, Pa., architect.
9. A modern colonial residence at Oak Lane, Pa., erected at a cost of $6,800 complete. Perspective view and floor plans. Mr. F. R. Watson, of Philadelphia, Pa., architect. An attractive design.
10. The residence of Rev. Samuel Scoville at Stamford, Conn., erected at a cost of $6,616. Mr. W. W. Kent, architect, New York. An excellent design.
11. Examples of interior decoration and furniture in the Moorish style.
12. A Queen Anne dwelling at Jenkintown, Pa., recently completed at a cost of $5,000. Messrs. Burke & Dolhenty, Wyncote, Pa., architects.
13. Miscellaneous Contents: The growth of plants in odd places.—Acoustics in buildings.—Improved steam power brick machine, illustrated.—A new style stamped ceiling, illustrated.—The telethermometer or distant temperature indicator.—The improved Thatcher furnace, illustrated.—Improved sash chains and fixtures, illustrated.—An improved sliding door latch, illustrated.—Aluminite in cement plaster.—Fire losses of 1893.—Graphite paint.—The Columbian sash and door lock, illustrated.—An improved sash lift, illustrated.

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Business and Personal.

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The new material, "Linenoid," Westfield, Mass.

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Improved iron planers. W. A. Wilson, Rochester, N.Y.

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Wanted—Light machinery or specialties to build. P. G. Fleming's Machine Works, Elizabeth, N. J.

Pipe frame truck baskets, steel and wooden trucks, etc. L. M. Moore, Rochester, N. Y. See page 399.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon. 24 Columbia St., New York.

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Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N.Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5796) A. M. S. asks: 1. I have a small electric battery motor rated at one-sixth horse power at 10 volts. Now I wish to run it from a lamp current from an Edison standard dynamo rated at 8 1-5 kilowatts, 125 volts, with 60 amperes as working load. How shall I proceed? Shall I have to put any lamps in the circuit? If so, how many? A. According to your figures, your motor can absorb a maximum of 7½ amperes at 10 volts. If used on a 125 volt circuit, you must put lamps or other resistance of 11 ohms and 10 amperes capacity in circuit with it. The system would involve great waste of energy. Sixteen 28 candle 31 volt lamps, four in parallel and four in series, or ten 94 candle power lamps in parallel, would give the result approximately This is on the assumption that the motor is shunt wound. 2. What would be the results to motor should I put on full potential of 110 volts? The motor is wound as follows: Armature 3 coils 1½ pounds No. 21 wire, field magnet single coil of 4 pounds No. 16 wire. A. It would burn out both field and armature.

(5797) D. D. W. writes: 1. Is the one horse power eight light dynamo, SUPPLEMENT, No. 600, a high tension machine? If not, what is a high tension and also low tension current? A. There is no such thing as a high tension or low tension current. A circuit can be thus described, reference being made to the maximum difference of potential existing between any two points of it. 2. With one-half horse power will it give about one-half as much current; one-fifth horse power, one-fifth as much current, as with one horse power? A. On short circuit this would be the general effect; on a circuit of high resistance the voltage would vary mostly; on an intermediate circuit both voltage and amperage would vary. 3. Will motor Nos. 641 and 161, with drum armature, run all right with current from this machine? A. The voltage is too high for the motors mentioned.

(5798) J. O. F. asks: If a small amount of caustic soda water accidentally introduced into steam boilers with feedwater would cause priming? We boil our double effect with very strong caustic soda water and have a considerable (inaccessible) leak, which, when steam is shut off and vacuum broken, allows the soda to enter the steam chamber, and when steam is again turned on is blown into feedwater heater. There can certainly be but a very small amount, but am unable to account for the behavior of boiler water otherwise. A. Pure caustic soda in small quantity will keep a boiler clean from incrustation by frequently blowing off the boiler, and will not cause serious foam. We assume, although you do not state it, that a little sugar goes into the boiler with the soda, which we have no doubt is the cause of the foaming. As a remedy, the water that leaks into the steam chamber should be blown out and wasted by an outlet in the pipe leading to the heater.

(5799) E. P. W. asks (1) how to make carbonic acid gas. A. Pour hydrochloric acid on marble dust. 2. What pressure it takes to liquefy? A. 36 atmospheres at 32° Fah. 3. How to condense it after expansion? A. By pressure applied by a pump.

(5800) R. S. C. asks: 1. How are the spots made on the barometer which you will find inclosed? A. They are marked with a cobalt compound; possibly the chloride. 2. How is fuse wire made for 110 volts? A. Fuse wire is calculated for amperage, not for voltage. 3. How should the hand power dynamo described in SUPPLEMENT, No. 161, be wound to give about 12 volts, to run an electric dental mallet? A. Use a drum armature with 500 turns of wire. See our SUPPLEMENT, No. 599. It is better to make the whole core of iron washers. 4. Where can I get the directions for making a steam siphon? Also what size suction and discharge pipe should I use for a quarter inch steam pipe? A. The size of discharge nozzle should be from two to three times the diameter of the steam nozzle. The smaller size for greater elevations, suction five times diameter of steam nozzle. The steam nozzle should be taper like a short hose nozzle and stop at three times its diameter from the discharge pipe mouth, which would be bell shape, to allow an easy entrance of the water. We have no detailed illustration of the siphon ejector. 5. Can the telephone used by the Bell Telephone Company be made by anybody after the last of January? A. The receiver can, not the transmitter.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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AND EACH BEARING THAT DATE.

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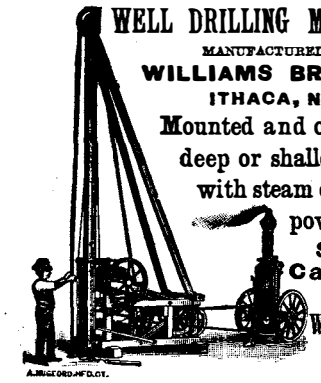

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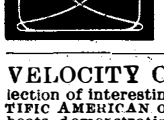

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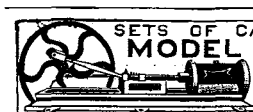

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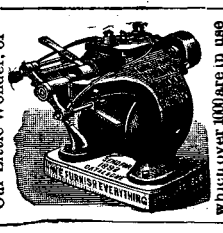

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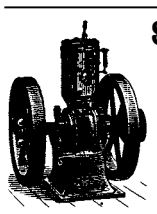

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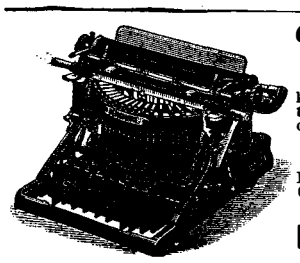

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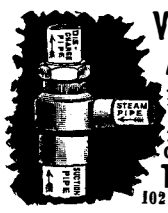

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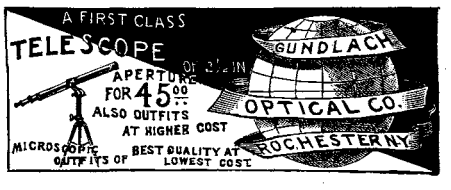

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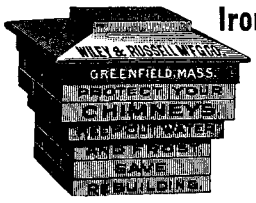

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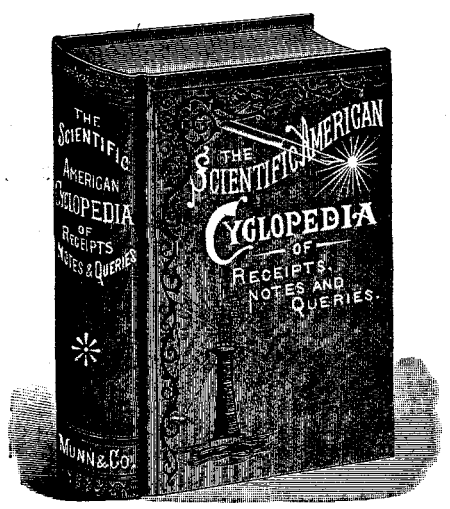

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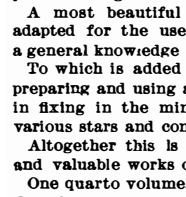

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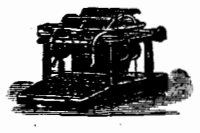

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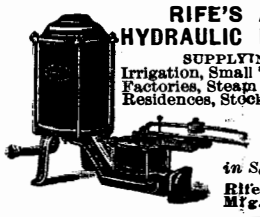

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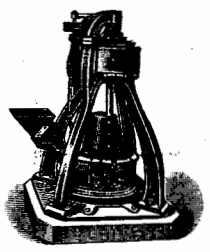

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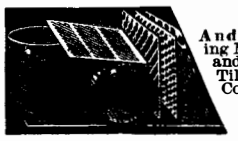

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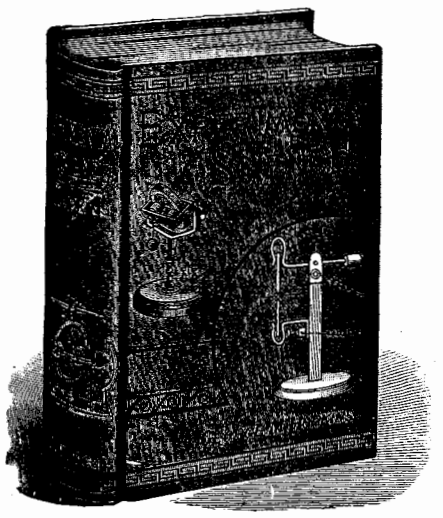

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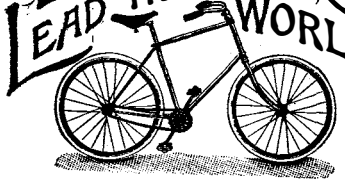

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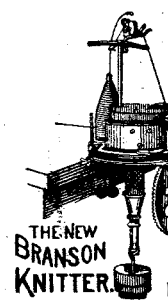

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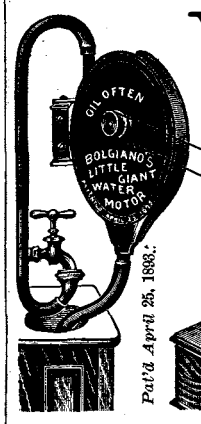

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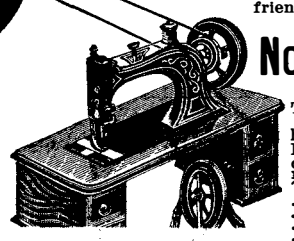

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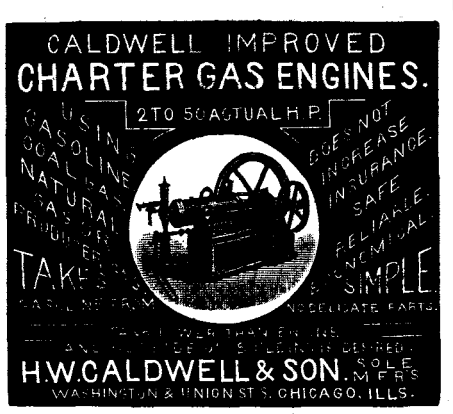

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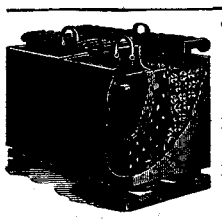

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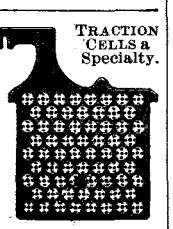

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